SCIENTIFIC AMERICAN

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THE ENGINES OF THE ST. LOUIS AND ST. PAUL.

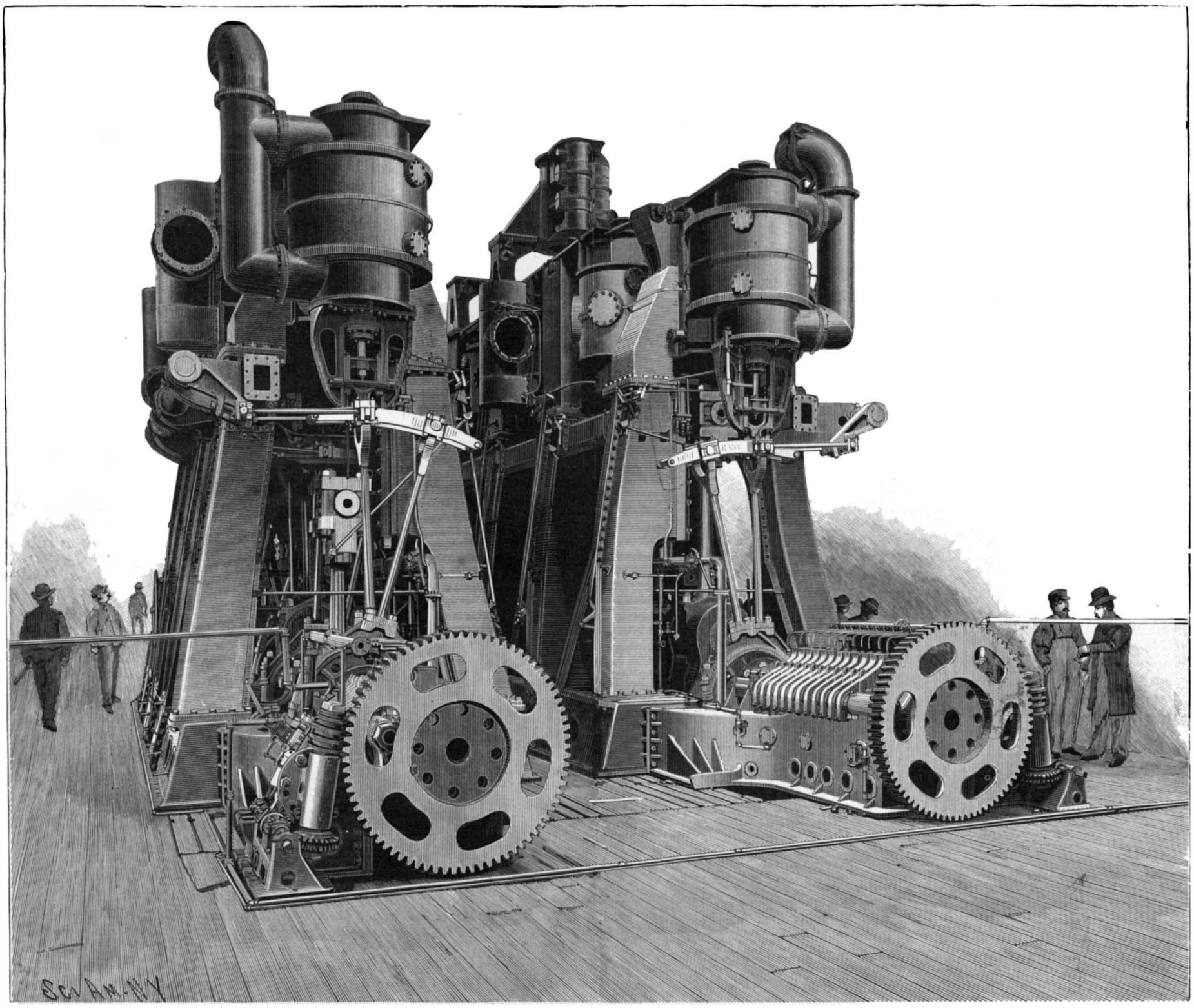
When it was first announced that an American shipbuilding firm had undertaken to construct a pair of 11,000 ton ocean mail steamers, and equip them with engines of 20,000 horse power, a doubt was freely expressed among the foreign shipbuilders as to whether so large an undertaking could be successfully carried through. The magnitude and novelty of the task is understood when we bear in mind that the tonnage was nearly four times and the horse power ten times as great as that of the largest steamers that this firm had hitherto built for the Atlantic trade. The four ships built by the Cramps Shipbuilding Company in 1872 for the American Steamship Company of that date were of 3,126 tons register and 2,000 horse power; and it was a great step from these ships, excellent as they were for their day, to the giant proportions of the later vessels.

The record of the St. Paul and St. Louis, however, has more than justified the expectations of their designers and builders. Both the horse power and the speed have exceeded the terms of the contract, and the St. Paul to-day holds the record on her own route, Southampton to New York, having crossed in 6 days, 5 hours and 32 minutes, at an average speed of 20·82 knots an hour.

The quadruple expansion engines of these ships are the largest on this system in the world, and they present many features of novelty in their design and construction. It is no light task that the engineer sets himself, when he sits down at his draughting board to make provision for the creation of 20,000 horse power, within the contracted limits of space which are assigned to the engines and boilers of a modern Atlantic liner. Mr. Thom, consulting engineer of the American line, who is responsible for the general design of these engines, has improved upon the common practice in large marine engines, by using a much higher pressure—200 pounds to the square inch—by adopting quadruple in place of triple expansion engines, and by transmitting the 10,000 horse power of each engine to the shafting by means of four instead of the usual three separate cranks.

These features in the engines of the St. Paul are directly in the line of development which marine machinery has been following since its earliest days, but they mark a long step in advance of anything yet attempted. The expansion of steam of the high initial tension of 200 pounds in six cylinders reduces the range of pressure in any one cylinder to a minimum, and thus gets rid of that most fruitful source of loss known as cylinder condensation. The distribution of the power among four cranks reduces the pressure upon the bearings, and keeps down the size of the low pressure cylinders. Of course, these advantages are in a measure offset by the fact that the number of surfaces in frictional contact, such as valves, valve gears, piston rings, etc., are multiplied, and the internal friction of the engine is theoretically increased; but the excellent working of these engines, which have now been twelve months in service, indicates that there is no difficulty experienced in actual practice.

From our engraving, which shows them as they appeared in the erecting shops after their completion, it will be seen that they are in duplicate, each set transmitting 10,000 horse power to its own screw propeller. The view is taken from the rear or thrust block end, the cylinder over the first crank being the second intermediate cylinder, of 77 inches diameter. The view of the engines from the forward end gives a greater impression of height, as the pair of low pressure cylinders are surmounted by a pair of high pressure cylinders, which can be seen in the engraving to the rear of the right hand or starboard engine. The distribution of the six cylinders is as follows: On the first crank is a 77 inch low pressure cylinder, surmounted by a 28½ inch high pressure cylinder; on the second crank are low and high pressure cylinders, duplicates of the first; on the third crank is a first intermediate, 55 inches in diameter; and on the fourth crank is a second intermediate, 77 inches in diameter. The ex-



TWIN QUADRUPLE EXPANSION ENGINES OF THE ST. LOUIS AND ST. PAUL.

Expansion in two high pressure, two intermediate, and two low pressure cylinders. Maximum horse power, 20,000.

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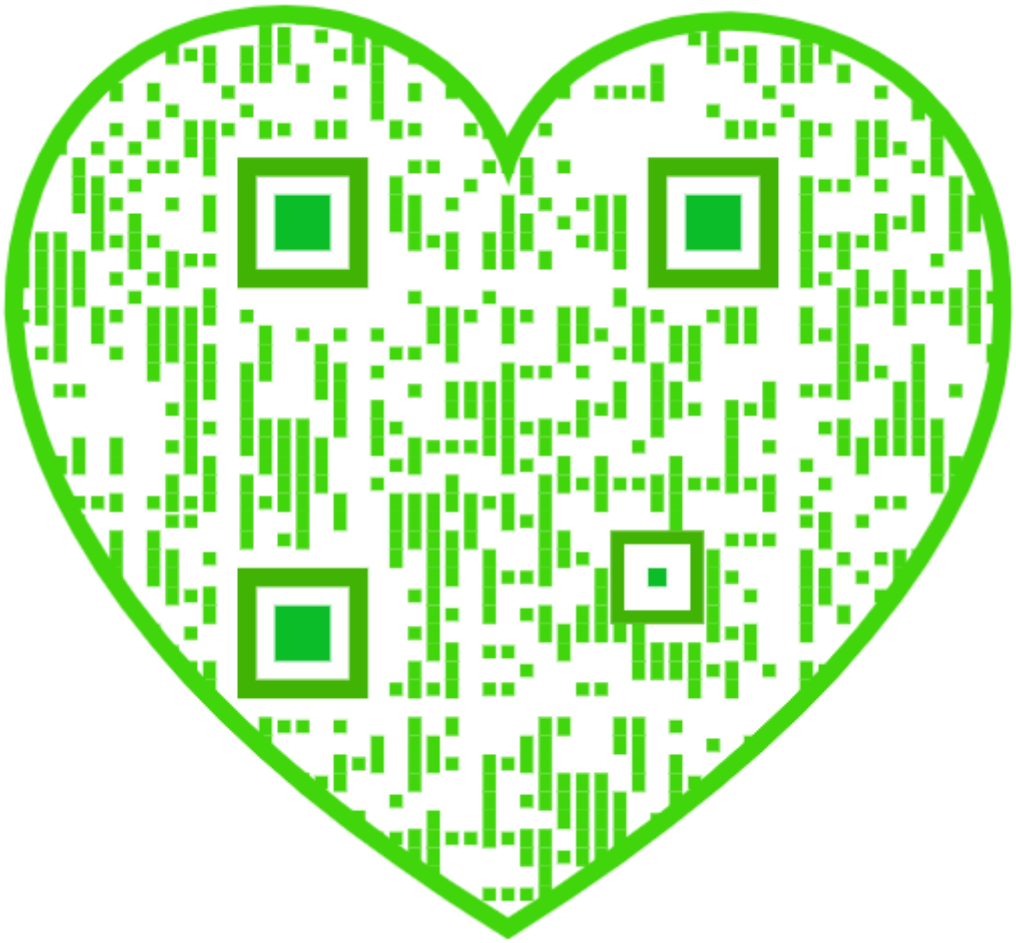

pansion is as follows: Steam at 200 pounds is admitted to the two 28½ inch cylinders, from them it passes to a 55 inch intermediate, then to a 77 inch intermediate, and finally to two 77 inch low pressure cylinders. All the cylinders have a 60 inch stroke.

The condensers have three-quarter inch brass tubes, and are 7 feet 2 inches diameter, and provide a total surface of 26,000 square feet. The air pumps and circulating pumps are of the Worthington type, the same firm providing the feed heater and feed pumps. The feed enters at 210 degrees. The condensers and pumps are not connected to the main engines, as in the Paris and New York, but are located separately in the wings of the ship. Balanced piston valves and Cramps metallic packing are used. This latter consists of cast iron rings compressed by a coil spring. The starting and reversing is effected by means of a separate engine. The crank shaft is 21 inches in diameter and hollow, and the propeller shaft is 19 inches in diameter and is made solid.

There are ten boilers in all, six double-ended and four single-ended. They are all 15 feet 7½ inches in diameter, and are respectively 20 feet and 10 feet long, the plating being $\frac{9}{16}$ inch thick. They are fitted with Fox's corrugated flues and 2¾ inch tubes. An interesting feature is the fitting of the tubes with "retarders," which cause the gases to follow a spiral path in the tubes, and so remain longer in contact with their surface. The total grate area and heating surface for all the boilers are respectively 1,144 and 40,300 square feet. They are worked under the system of forced draught invented by Mr. Howden, which, in addition to the economy that it secures, is a positive blessing to the men in the stokehold, which can be left open. This may be considered as a great advance upon the closed stokehold system of forced draught, which, as its name implies, involves the closing up of all openings between the hold and the outside air, the interior of the stokehold being under a constant pressure of air.

In the Howden system, as installed on the St. Paul, the air is drawn by means of fans through heating chambers situated at the front end of the boilers, where it is heated by the gases from the furnace as they pass to the smoke stacks.

It must be borne in mind that, in addition to the main engines shown in the engraving, there are numerous auxiliary engines, such as those for driving the electric light dynamos, and the ventilating and refrigerating plants; not to mention the numerous steam capstans and windlasses, which form part of the equipment of a modern steamship.

There are certainly no large marine engines afloat whose performance is being more critically watched than those of the St. Louis and the St. Paul, and the fact that the record-breaking trip of the latter ship was made on a consumption of 310 tons of coal per day shows that they are very economical on fuel.

The Tennessee Centennial.

By proclamation of the governor and in accordance with the patriotic desire of the people of the State, June 1 and 2 were public holidays in Tennessee, and Nashville, the capital, was the scene of a series of public demonstrations of rare splendor, initiated and consummated in honor of the one hundredth birthday of the Volunteer State. The United States Marine Band and five regiments of the United States cavalry, artillery and infantry headed the magnificent parade, which was of such length that it was two hours and thirty minutes passing a given point.

The procession moved through the city and rested at the grounds of the Tennessee Centennial Exposition, which was formally inaugurated in connection with the centennial ceremonies. A striking feature of the occasion was the hoisting to the peak of a flagstaff 305 feet high of the flag of the United States, while the Marine Band played the "Star Spangled Banner" and the thousands of people were cheering. Congressmen, the United States Geological Survey, many State and Federal officials, the corps of Washington newspaper correspondents, and many prominent citizens from all parts of the country were present. Six of the great buildings that will fill the central plan of the exposition thus inaugurated are either finished or nearly so, and the construction of the remaining eight will be begun at an early date. To these will be added the countless smaller edifices, and the exposition, complete and beautiful in detail and in ensemble, will open to the public May 1, 1897, and continue six months.

THERE are in the United States, it is stated, 200,000 machinists, 10,000 tool makers, 25,000 boiler makers, 10,000 pattern makers, 750,000 carpenters and joiners, 200,000 masons and bricklayers, 50,000 contractors and builders, 50,000 plumbers, gas and steam fitters, 150,000 stationary engineers and firemen, 100,000 locomotive engineers and firemen, 50,000 electric railway and light employes, 50,000 cabinet makers, carvers and woodworkers, 50,000 civil, mechanical, electrical, and mining engineers.

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OUR JUBILEE NUMBER.

We had hoped in this issue to announce the winner of the prize for the best essay on the "Progress of Science during the last Fifty Years," but the judges had not finished their examination of the numerous manuscripts at the time of going to press. Attention is called to this jubilee number, which will be one of unusual interest to all desirous of acquiring within small compass a resumé of what has been done in the department of science during the past fifty years. The next issue will be about four times the size of an ordinary issue. We hope our readers and friends will call the attention of their acquaintances to it, in order that they may apply for the paper in advance and therefore receive the paper without delay.

THE ARTISTIC ELEMENT IN ENGINEERING WORKS.

At a recent meeting of the commissioners of the proposed new East River Bridge, to join New York and Brooklyn, one of the members, Mr. Salem H. Wales, referring to its architectural features, said: "In this country this portion of the work has been neglected on almost all of the great bridges that have been built, and, whenever any attention has been paid to it, it has usually been considered of so little importance that it has been put in the hands of a draughtsman, or some one of little or no artistic ability." Mr. Wales concluded by stating that "at the proper time he would be prepared to present the name of an architect competent in every way to treat this matter in collaboration with the chief engineer."

Except that we think his condemnation of the architectural, or ornamental, features of our large bridges is too sweeping, we agree with the suggestions of the commissioner, and are of the opinion that there are many occasions, not merely in bridge building, but in various other departments of civil engineering, when the engineer and the architect could collaborate to good advantage. The question of the architectural embellishment of engineering work is as old as these arts themselves. The skillful treatment which marks the remains of those ancient structures which properly belong to the domain of engineering would seem to prove that the engineer and the architect were formerly combined in one individual. This was true of the days of the Roman Empire, as the remains of their aqueducts and bridges plainly testify; and in later medieval days, the daring heights to which the builders of the Gothic cathedrals carried their lovely but fragile aisles and transepts, towers and spires, is clear evidence that beneath the monkish cowl was hidden both the constructive mind of the engineer and the artistic perception of the architect.

This dual capacity was rendered possible by the materials of construction in which the early builders wrought and the comparative simplicity of the problems with which they were confronted. They worked in the primitive materials, wood and stone; the thrust of the arch and the bearing capacity of the column were the most serious questions that occupied the engineer-architect of ancient and medieval times; and what these were he had learned from many a bulging wall and crumbling pier. When he raised those monumental piles of stone which are the despair of the modern architect, he was hampered by no considerations of mere utility; indeed, the uses to which a structure were to be put were often made subservient to the general architectural effect. Not content with grace and dignity of outline, he would often clothe his completed structure with a rich garment of delicately carved tracery, softening the severity of its outlines and adding beauty of detail to the dignity of the general effect.

But the coming of the age of steel has revolutionized the art of construction in all those departments to which it can be applied; and out of the crude theories which governed the age of wood and stone have been developed the exact scientific methods of modern engineering. The high cost of iron and steel forbade that prodigal use of material which marked the age of stone construction—nor was it necessary. The element of economy entered into the question of design, and led to a careful investigation of the stresses to which a structure was subjected, and an intelligent proportioning and disposition of the material to meet those stresses.

With the development of the art of steel construction, and the increase in the number and complexity of the problems which it involved, the line of demarkation between the engineer and architect began to grow more distinct, until to-day it is common practice for the architect to call in the aid of the engineer to design the structural steel work which gives stability to his buildings.

The primary motive—if we may so speak—of the engineer and the architect is different. The proportions which an engineer gives to a bridge, for instance (since this is the form of construction under consideration), are not primarily, if at all, determined by any abstract considerations of beauty. These proportions are determined by certain hard and fast principles of mechanics, which are as unchangeable as the fact that 2 and 2 make 4, or that the whole is greater than its part. It is quite possible that the result will not ap-

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peal to the æsthetic sense of the artist; and this is more his misfortune than his fault. To the eye of the engineer, the combination of the straight lines of the bottom, and the curved lines of the top, chord of a truss bridge is strictly beautiful, inasmuch as it expresses in concrete and useful form those unchanging physical laws on which the equilibrium of the whole universe depends.

To a captious critic who called the giant cantilevers of the Forth Bridge ungainly, their eminent designer replied that the most lovely column from the Parthenon at Athens, if set up as the smoke stack of an Atlantic liner, would be grotesque in the extreme.

The various parts of any properly designed engineering construction are beautiful only so long as in shape and bulk they exactly represent the various functions which they are supposed to perform.

To attempt, for instance, to adorn the simple structural shapes of a modern steel truss with fanciful designs is to belittle its appearance, and turn the expressive and truthful simplicity of their outline into a hollow and meaningless sham. Scrolls and traceries, bosses, shields, and interlacing triangles, which are glorious in a cathedral, are grotesque on a steel bridge.

It is probable that the commissioner above quoted, in suggesting the co-operation of an architect with the engineer of the East River Bridge, had in mind merely the stonework of the piers and approaches; and here we think that there is a legitimate field for the display of architectural skill. Among the many architectural styles, that one should be chosen which most nearly agrees with the character of the bridge itself. In most cases however it may be safely laid down that whatever style be adopted, it is scarcely possible for the architect to err upon the side of too great simplicity or severity of design.

THE INTERNATIONAL GEOLOGICAL CONGRESS AT ST. PETERSBURG, AUGUST, 1897.

Professional geologists and all other persons interested in geology will be interested in the announcement which has just been made concerning the plans of the committee of arrangements having in charge the seventh triennial meeting of the International Geological Congress, which will take place in August, 1897, at St. Petersburg, by invitation of the Russian Emperor. A grand programme is proposed by the committee, and no effort is being spared to enable the members of the congress to take advantage of this unique opportunity to study the geological and topographical features of Russia in Europe, the Emperor himself offering all the visiting geologists free transportation, first class, over the Russian railways, before and after the sessions of the congress, including the excursions.

Membership in the congress is open not only to professional geologists, but also to other persons interested in the science, and may be obtained in accordance with conditions which may be learned by addressing the secretary, whose address is given below. The meeting will extend over eight days, and the sessions will be devoted to discussing general principles of geology and the present state of the science in the effort to bring about harmony among the geologists of the world. Much time will be given to the exposition of the geological work being done in Russia, especially in those regions covered by the excursions. The usual facilities will be given for the display of instruments, maps and books pertaining to geology.

The excursions offered before and after the congress are bewildering in their extent and attractiveness, and only the most meager outline of them can be given here. The principal tour proposed before the meetings is from Moscow, eastward to the Ural Mountains, crossing that chain and visiting several famous mineral and mining localities, including Ekaterinburg and Tagilsk and returning by way of Perm to Moscow. Persons especially interested in historical geology will, however, take the excursion into the province of Esthonia, while those who prefer crystalline rocks and glacial geology will spend six or seven days in Finland. A grand excursion which will occupy a month is proposed for the time immediately following the close of the congress in St. Petersburg. After visiting Moscow and its environs in a body the party will split up into three divisions, one section going by way of the Donetz valley to the baths of Vladikavkaz, the second going by the Volga River, and the third by the Dnieper valley to the same rendezvous. Thence the route leads over the Georgian military road to Tiflis, stopping on the way to visit some of the glaciers of the Caucasus Mountains. From Tiflis a visit will be made to Baku, the headquarters of the petroleum fields of the Caspian Sea, and afterward to Batoum, on the Black Sea, whence ship will be taken for Kertch, where a study of the Crimea will be begun which will end at Sebastopol, where the congress will finally dissolve. Six alternative and supplementary trips are offered in connection with the great tour, for those who are particularly interested in mines, in glaciers, in the ascent of Mount Ararat, etc.

Persons expecting to attend the congress are requested by the committee to notify the general secretary of the congress by next October as to which of the excursions they propose to take. The president of the congress is A. Karpinsky, director of the geological survey of the Russian empire, and the secretary, to whom all communications should be addressed, is Th. Tschernyschew, St. Petersburg.

The last meeting of the congress was in 1894, at Zurich, and the one preceding that was at Washington, in 1891, in connection with the American Association for the Advancement of Science and the Geological Society of America.

Steam Road Rollers and Gas Pipes.

The gas companies in England have found that the use of steam road rollers has had a bad effect upon gas pipes under streets. We have not heard this complaint from gas companies in the United States, says the Engineering Magazine, but it is the practice here, at least in the colder parts of the country, to place both water and gas mains deeper in the earth than in England. The trouble has become sufficiently pronounced in England to be made the subject of a paper by Mr. Norton H. Humphrys, Assoc. M. Inst. C.E., printed in Journal of Gas Lighting, who asseverates that, while the results of steam road rolling may be entirely satisfactory to civil engineers, the gas companies do not regard them with complaisance. An abstract of this article follows:

On good roads accustomed to carrying a large and heavy ordinary traffic, including four-horse vans and traction engines, and which have been well maintained and kept in good order, the steam roller does not put itself much in evidence. But, when one of these implements is for the first time put upon a by-street or a country road accustomed to small and light traffic, and which has received but little attention in the way of maintenance, beyond an occasional scrape in unusually wet weather and a sprinkling of stones from a cart at rare intervals, the gas engineer becomes more intimately acquainted with "The Luck of Eden Hall" properties possessed by the steam roller than is good for his own comfort or the prosperity of his undertaking. Difficulties from drawn services and fractured mains—ranging from the slight crack of a few inches long up to complete severance of the pipe—become common occurrences.

A comparison of gas pipes with water pipes with reference to their respective requirements shows that this is not because water engineers are more thorough in their work. Following on the lines of the usual rule that, if the gas gives a bad light, the company is at fault, it is agreed that, if the gas pipes break, they must be bad pipes; and many members of corporations, etc., arrive at the conclusion that there must be special negligence in putting down, or selecting, the sections or quality of the pipes to be used for the conveyance of gas. So far from getting any sympathy in their misfortune, which has arisen from causes that could not possibly have been foreseen, the unfortunate gas company is blamed for not laying down pipes at a reasonably sufficient depth, or for purchasing cheap stuff of a rotten or gingerbread character. A common argument in support of this view is the fact that gas pipes are injured more frequently than water pipes.

The relations between the shape of the roller, its weight and the mode of using it to the damage done upon the pipes is discussed at length, and the tendency toward using greater weight is deprecated. Water engineers have not been more prudent, nor have they exercised more care or foresight as to possible contingencies. Neither do they generally do their work in a stronger or more substantial manner than do gas engineers. The trouble is simply a natural consequence, due to the different natures of the services performed. The internal pressures to which the gas service is exposed is a mere trifle—a matter of a few ounces per square inch. But water pipes are subjected to heavy pressure in low levels, representing a large number of pounds per square inch. Gas pipes in themselves are not interfered with by frost, except as regards its effect on the soil surrounding them; but the formation of ice in water pipes must be prevented, as it not only stops the supply, but also fractures the pipe. It would be as reasonable to adduce the fact that the main sewers are never injured by the roller as to compare water pipes with gas pipes.

Life in the Animal Kingdom.

Man lives to all ages, but in the animal kingdom, on the contrary, the duration of life is almost exactly equal for all individuals of the same species. But we can know with exactness the real duration of life only for animals in servitude; we do not know whether it is the same in the savage state. Rabbits and guinea pigs live seven years; squirrels and hares, eight; cats, nine or ten; dogs, ten or twelve; foxes, fourteen to sixteen; cattle, fifteen to eighteen; bears and wolves, twenty; the rhinoceros, twenty-five; the ass and the horse, twenty-five to thirty; the lion, thirty to forty (a lion in the London Zoological Gardens reached the age of seventy years); the camel, forty. The length of life of the elephant is uncertain; according to Aristotle Buffon, and Cuvier, it lives two centuries; some authors say even four or five. After his victory over Porus, Alexander consecrated to the sun an elephant that had fought for the Indian monarch, and gave it the name of Ajax; then, having attached an inscription to it, he set it at liberty. The animal was found 350 years later. The ancients attribute to the stag a fabulous length of life, but Aristotle observes that what is reported on this subject has no good foundation. . . . Buffon says that the stag takes five or six years to attain full growth and should live seven times this period—that is, thirty-five or forty years.

Though precise observations are wanting, we know that fishes, especially the large species, live a very long time. According to Bacon, eels reach sixty years. Carps have been known to live at least 150 years, and they then seemed to Buffon as lively and agile as ordinary carp. Dolphins, sturgeons, and sharks live more than a century and attain huge size. Pikes have been seen weighing 1,000 lb., which indicates a very long existence. A pike caught at Kaisers-Lautern in 1497 was 19 feet long and weighed 350 lb.; it bore in its gills a copper ring with an inscription stating that it had been put in the pond of Lautern by order of the Emperor Frederick II—that is, 261 years before. Whale fishers have exterminated the huge whales of the polar seas; those that were formerly met with were of prodigious dimensions. It is supposed, with some probability, that they live several centuries and that they may even reach an age of 1,000 years. The longevity of fish is attributed to the long duration of the development, to their low temperature, and to their feeble vitality.

On the other hand we meet another class of animals whose passions are lively, whose vitality is very active, and who still live a long time—we mean birds. But it is not known with any degree of precision how long these live, except that their longevity is great. We see the same swallows returning to their accustomed nest for a considerable number of years. An eagle died at Vienna at the age of 103 years. According to Buffon the life of the crow is 108 years, and no observation authorizes us to attribute to it, with Hesiod, 1,000 years. A paroquet, brought to Florence in 1633 by the Princess Provere d'Urbin, when she went there to espouse the Grand Duke Ferdinand, was then at least twenty years old, and lived nearly 100 more. A naturalist whose testimony cannot be doubted, Willoughby, had certain proof that a goose lived a century; and Buffon did not hesitate to conclude that the swan's life is longer yet; some authors give it two and even three centuries. Mallerton possessed the skeleton of a swan that had lived 307 years. This is quite enough to prove that among the larger animals, and also especially among birds, the duration of life, relatively to their bulk and height, is very long: it is, on the contrary, very short with insects; many of these live less than a month, rarely a few years, while the life of the ephemerids is but seven to twelve hours, and in this brief space they accomplish the principal functions that nature requires of organized bodies: they are born, reproduce, and die.—Journal d'Hygiene, Paris.

Knots Tied by Machinery.

If inventions continue to multiply at the present rate, the day may speedily come when man will have to sit with folded arms while his work and even his pleasures are turned out for him by nickel in the slot devices. Science has lately given us a marvel in the shape of a card-counting machine.

Two of the most interesting automata now working within the limits of the United States are those used by the government for counting and tying postal cards into small bundles. These machines were made in Connecticut, and the two are capable of counting 500,000 cards in ten hours and wrapping and tying the same in packages of twenty-five each. In this operation the paper is pulled off a drum by two long "fingers" which come up from below, and another finger dips in a vat of mucilage and applies itself to the wrapping paper in exactly the right spot. Other parts of the machine twine the paper around the pack of cards and then a "thumb" presses over the spot where the mucilage is, and the package is thrown upon a carry belt ready for delivery.—The Argosy.

THE London correspondent of the New York Sun states that an Antarctic expedition has been arranged for next winter. It will be partly a trading and a scientific enterprise, and will be under the command of Capt. Svend Foyn, of Christiania. W. S. Bruce, of the Ben Nevis Observatory, will have charge of the scientific party, composed of himself and four other men. The scientific party will be landed on the Antarctic continent in Victoria Land in January next, and the vessel will then engage in whale and seal fishing, returning to Australia. The following season, in January, 1898, she will return and take off the scientific party, who hope by then to have obtained knowledge of the fauna, flora, geology, and topography of the Antarctic region. If found practicable, an attempt will be made to reach the south magnetic pole.

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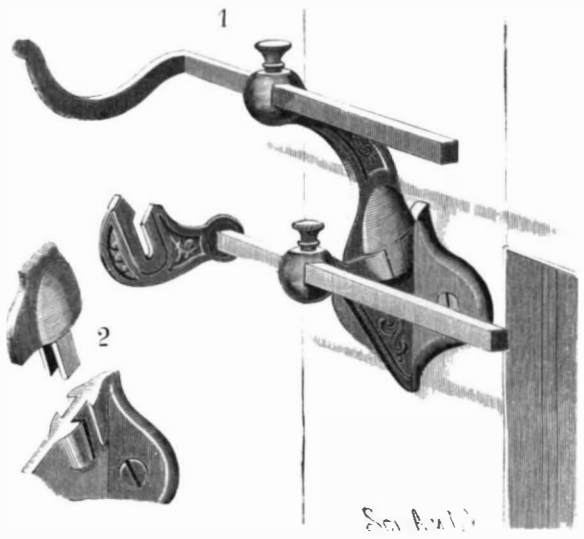
CURTAIN OR SHADE FIXTURE.

The handy contrivance shown in the accompanying cut has recently been patented by Mr. Oliver H. P. G. Spencer, of Mount Carmel, Illinois. The object of the invention is to provide a fixture consisting of two separable brackets, one for supporting the shade roller and the other for supporting a curtain pole, and to arrange the brackets so that the curtain will fall outside and clear of the shade roller. The device also makes it possible to utilize a roller or pole of greater or less width than the window, without cutting or building up the former. The fixture consists of four brackets, two for each side of the window, the lower



SPENCER'S CURTAIN OR SHADE FIXTURE.

bracket being screwed to the window frame and the upper bracket being slidably adjusted on the projecting web of the lower bracket by means of two tongues, engaging corresponding grooves which are provided for the purpose. The projecting web of the lower bracket terminates in a knob, which is provided with a thumb screw and is perforated with a square horizontal hole, in which a rod, which carries at its end a curtain fixture adapted to receive a trunnion of the curtain roller, is fitted to slide horizontally. As each bracket on each side of the window is similarly furnished, it is evident that any length of shade may be used, the curtain fixtures being adjusted accordingly in the brackets. The upper bracket is similarly provided with a perforated knob and a thumb screw, the rod which it carries being provided with semicircular hangers, adapted to receive the curtain rod. These brackets curve upward and outward sufficiently to carry the curtain rod entirely clear of the shade roller.

Tattooing by the Maori Race.

Major Gen. Robley is the author of a singularly curious book, "Moko; or, Maori Tattooing." The New Zealand war of 1864–66, in which the author served, gave him his opportunity of studying on the spot that now almost extinct art. The expression, a well chiseled face, meant one thing to a Christian sculptor and another to a Maori decorator. The work contains more than 150 illustrations of designs and tattooed heads. There is no denying the fact that the Maoris could appreciate the beauty of lines and curves. One witnessing the really striking examples of their architectural ornamentation exhibited in South Kensington cannot but regret that they did not work less upon the human skin and more upon some other material. In Gen. Robley's book, which is to be a two guinea quarto, beautifully printed, the history of the art is sketched and the various processes explained. The second section of the book deals with preserved heads, many of which, dating from 1770, are kept in European museums. It seems there are few, if any, such heads later than 1831, "when the traffic in Maori heads ceased." An illustration entitled "Preserved Heads of Maori Warriors Arrayed in Robes and Displayed by their Conquerors," is singularly lifelike. It betrays at least a rudimentary sense of statuesque drapery.

IMPROVED WASHING MACHINE.

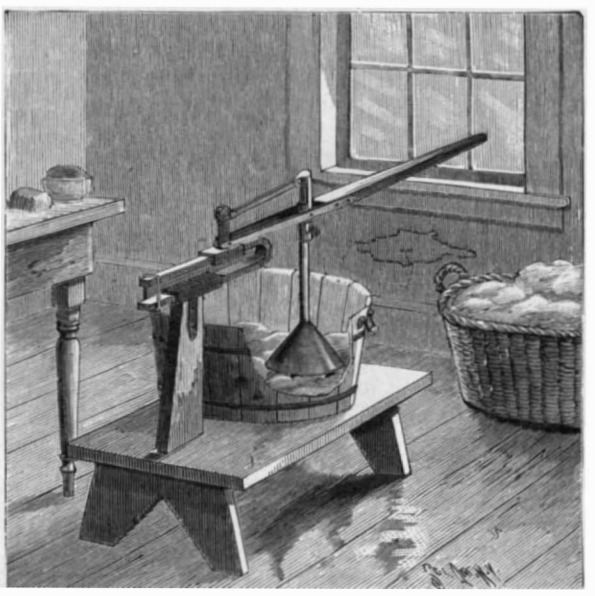
Some improvements in the method of mounting the plungers of washing machines have been designed and patented by Mr. William Powe, of 1327 Richard Street, Vancouver, British Columbia, Dominion of Canada. By reference to the accompanying engraving, it will be seen that one arm of a U-shaped bar is rigidly secured in a casing, mounted at the top of a standard, which is secured on the bench, as shown. The ends of both arms of the bar are secured by a link which is seated in notches formed on said ends. Freely movable on the upper arm of the bar is an angular sleeve, carrying a vertical post, on which a sleeve is rotatably mounted. The lever of the washing machine comprises a handle and two parallel bars, whose further ends are pivoted to the lower end of the last mentioned sleeve. The shaft of the plunger is provided with a sleeve which is pivoted at its center to the parallel bars of the horizontal lever, and at its upper end to one end of a parallel link, the opposite end of which is pivotally connected to the top of the rotatable sleeve, on the vertical post before mentioned. The plunger is of the common funnel shape. By means of this construction the plunger will be capable of a universal movement, and, moreover, its support is independent of the tub, so that the latter may be taken from the bench, without interfering with the plunger and its supporting mechanism.

CAVE EXPLORATION IN THE EASTERN UNITED STATES.

BY HENRY C. MERCER.

To learn that the remains of Pleistocene man have been abundantly found in the caves of Europe, that equally significant remains of later savage, barbarous and civilized peoples have been similarly discovered in the caves of Europe, Asia and Africa, and that the remains of the Indian and the recent white man have been found in caverns in North America, warrants the supposition, nowhere disallowed by past investigation, and valuable as an hypothesis, that primitive peoples generally throughout the world have left traces of their presence upon the floors of accessible caves. In the subterranean floor deposits of the new world, therefore, we may suppose that the problematic existence of Pleistocene man might be soonest and easiest demonstrated, while with hardly less ground we may urge as valuable testimony in the American region the absence of such remains in significant underground shelters. Not unreasonably such absence, occurring invariably at these immemorial halting places of men and animals, might infer that Pleistocene man had never existed in the adjacent regions.

By this course of reasoning and investigation the University of Pennsylvania has sought to solve definitely the question first to attract and last to puzzle American students—How long has man existed in the new world? Striving to limit the speculations of archæologists, the work has proceeded by degrees to reconcile with geology their study of pre-Columbian peoples, which, fascinating as it is, has lacked thus far subdivisions, landmarks and starting point, while an

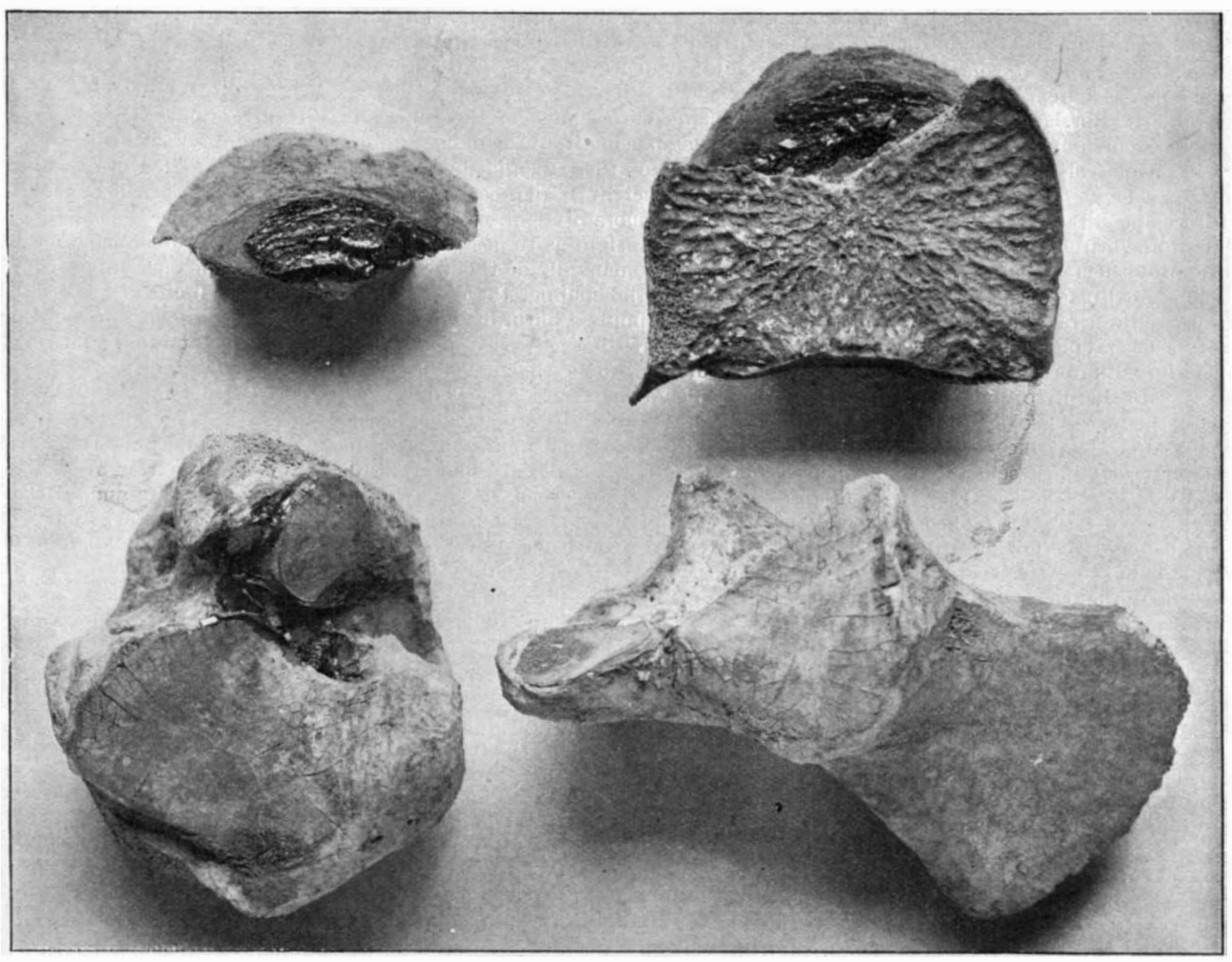


POWE'S IMPROVED WASHING MACHINE.

effort to eliminate, through the investigation of significant caves, one region after another from the field of search, has sought to narrow the area of possible discovery from the point of view explained. Having shown on the one hand that certain caverns like the fissure at Port Kennedy (right bank of Schuylkill River, three miles below mouth of Perkiomen Creek, Montgomery County, Pa.), containing in large quantity the remains of Pleistocene animals without relics of man, are geologically ancient, on the other hand a fact of much significance has been demonstrated for the first time, namely, that a considerable number of other caves are modern, since their floors, well supplied with the first refuse of Indians and later white men, below which remains of geologically older peoples would not have been lacking in Europe, have failed to reveal any relic of Pleistocene man.

In these several instances the geologically modern remains (human) and the geologically ancient remains (animal) have lain apart in distinct caves, and hence less availably for comparative study, but the recent expedition to Tennessee, resulting in the examination of three caves in which the old and new deposits lay in juxtaposition, has enabled us to push the question farther by studying the relation between the ancient and modern strata where, at their point of contact, it was most significant.

More broken and scattered even than at the remarkable tomb of extinct animals at Port Kennedy were the remains of the tapir, peccary, bear, and small fossil rodentia at Zirkel's Cave (left bank of Dumpling Creek, about five miles above its mouth in French Broad River, Jefferson County, Tennessee), visited by Professor Cope in 1869. Dislocated as before after the flesh had rotted from the bones, crushed by a force which had split into fragments the hard teeth, the remains had found their way into a mass of clay mixed with lime, which at one time filled the cave. Hardened finally into breccia not easily broken with the pickax, this bone-bearing earth had disappeared at many



Bones of the fossil sloth (Megalonyx), astragalus calcaneum and epiphysis of vertebra fresh in appearance and with remains of attached articular cartilages found associated with the refuse of porcupines and cave rats in a dry passage 900 feet inward from the entrance of Big Bone Cave, Van Buren County, Tennessee, May, 1896. Two-thirds natural size.

BONES OF THE FOSSIL SLOTH.

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points to make room for a deposit of cave heart containing the remains of the rattlesnake, woodchuck, opossum, rabbit, and cave rat. and it is the important relation of this latter modern earth, with its bits of mica and Indian pottery, to the older breccia that will constitute the material for a final report.

Previous examination, in 1893, at the Lookout Cave (left bank of the Tennessee River, one quarter of a mile below Chattanooga Creek, Hamilton County, Tennessee), had revealed the bones of the tapir and mylodon in the lowermost zone of a floor deposit of Indian refuse, and upon the recent expedition the cave earth with its "culture layer" was entirely removed for 58 feet inward from the entrance to settle beyond doubt the relation of these fossils to the Indian remains resting upon them. At this significant spot, where again the Pleistocene and recent deposits lay in contact, and where the specimens found were labeled according to their position, whether from the black (modern) earth above or the yellow (ancient) earth below, a completed examination should decide whether man had or had not encountered the tapir and mylodon in the Valley of the Tennessee.

After a visit to "Indian Cave" on the Holston River, Carrol's Cave, and the Copperas and Bone Caves, near Tullahoma and Manchester, Tennessee, a new set of conditions was presented at Big Bone Cave (one mile from left bank of Caney Fork and about two miles above its mouth in Rocky River, Van Buren County, Tennessee).* There the bones of the gigantic fossil sloth (megalonyx), still retaining their cartilages, were exhumed from a dry deposit of the refuse of porcupines and cave rats, mingled with fragments of reeds used as torches by Indians in a gallery 900 feet from the entrance, thus presenting us in the final summing up of this strange evidence a new notion of the relation of the modern Indian to this extinct animal, whose remains outnumber all its fossil contemporaries at Port Kennedy.

Thanks are due to Dr. William Pepper, to the board of managers and to Professor E. D. Cope, for their kind co-operation in the expedition thus finished, which has presented the museum with the specimens now under examination. These, if not attractive, are important. For paleontology they mark in the bone breccia of Zirkel's Cave a distinct stage in the Pleistocene series, while for anthropology they represent data which account for the presence of man together with the bones of the extinct megalonyx. They explain the relics of savages and the remains of Pleistocene mammals at two caves situated in the Eastern Valley of Tennessee, at a height of about 600 to 700 feet above the sea and within earlier reach of a overwhelming ocean in Champlain time, and again at a third cave, which, 300 feet higher on the continental floor, and looking westward from the slopes of the Cumberland table land, stands for that part of the Appalachian region whither animals and man (if he existed) might have found convenient refuge when lower areas sunk, as is alleged, beneath the level of the invading waters.

* This cave was explored by Mr. Henry C. Mercer, curator of the section of American and prehistoric archæology, Museum of Science and Art, University of Pennsylvania, at the suggestion of Prof. James M. Safford, of Nashville, Tenn.

PREPARING OLD WOOLEN RAGS FOR SHODDY CLOTHING.

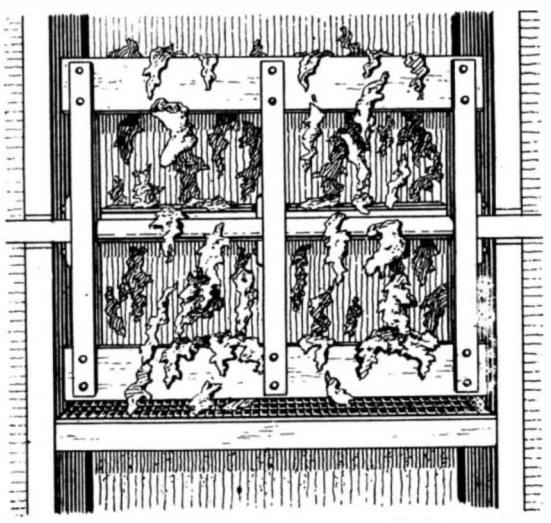
Shoddy consists of old woolen rags and shreds of stockings, flannels, and other soft worsted fabrics torn and reduced to such fragments as can be made by the operation. A similar preparation, called "mungo" or "mingo," is made in the same manner from rags and clippings of milled woolen cloth, being divided into new mungo from tailors' waste and old mungo from rags of all degrees of degradation. Where cotton and wool have been woven together into cloth, the former is burned out by treating the material with a solution of sulphuric acid, and heating it in a stove, the acid attacking and charring the cotton and leaving the wool unharmed. Shoddy cannot be used without a certain amount of natural length wool, usually about one-third being used in spinning shoddy yarn.

Large quantities of old clothes and rags of every description are imported into this country from England, Germany and France. The material comes here packed up tightly in bales weighing from 500 to 1,000 pounds each, the stock costing, if old and dirty, from 3 to 5 cents per pound; if of good quality, about from 8 to 10 cents per pound. When the wool is cleaned and in good order, it will sell from about 14 to 24 cents per pound. The cloth and rags are picked and sorted over by women and girls of different nationalities, such as Italians, Poles, Russians, etc. The material is placed upon tables for that purpose, the women picking out each rag and shred, carefully examining the color and quality. The pieces of cloth are then put into separate boxes, according to the color and quality of the material. The boxes are made of wood and are about 4 feet in height and about 18 inches square, and will hold about 50 pounds each. Each hand can sort about 90 pounds daily. After the stock is sorted it requires cleaning to free the material of dirt. This is performed by passing the stock through what is called a duster. This apparatus is a square boxlike structure, inside of which is a revolving wheel made of wood about 4 feet in diameter, containing four paddles, the blades of which are about 4 feet in length and about 8 inches in width. The material, to the amount of about 50 pounds, is placed in the apparatus; the paddles, which revolve at the rate of about 300 revolutions per minute, striking the rags and throwing them against the sides of the structure, which forces out the dirt, the dust being carried off at the top by means of a two-foot blower. The dusting operation takes about one minute. The stock, according to the quality and color, is then put into bins holding about 1,000 pounds each, ready for packing into bales. Where the stock is composed of old clothing or any material containing seams or patches, it is necessary to cut them out, so that the cotton can be burned out. The seams are cut out by women and girls with shears and knives, the operation for each suit taking about 10 minutes. The strips of cloth are then dusted and the cotton in the seams burned out with sulphuric acid, as stated above. The rags, when sold, are then pressed into bales weighing about 700 pounds each. The rags are thrown or dumped down into a boxlike structure having a movable bottom, which is raised by means of four movable iron arms. These arms, when in position to raise the bottom of the press, are diamond-shaped, the two upper ends of the upper arms being hinged to the press bottom and the two lower arms hinged in the same manner to the flooring below. The central ends of the arms are connected to a horizontal spiral screw, which passes across the center of the diamond, which, when set in motion, cause the arms to draw inward, straightening them out and causing the press bottom to move upward, which in turn presses the rags tightly together against a heavy movable wooden frame above, which is moved over the rags when the press is filled. The arms raise the bottom up about

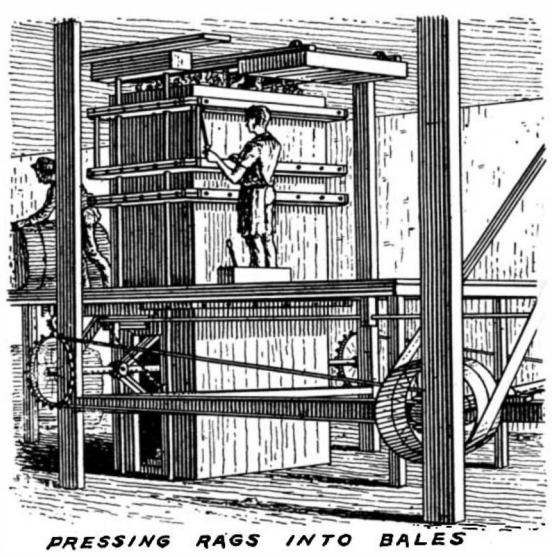
CUTTING OUT SEAMS FROM CLOTHING

SORTING OUT DIFFERENT COLORED RAGS.

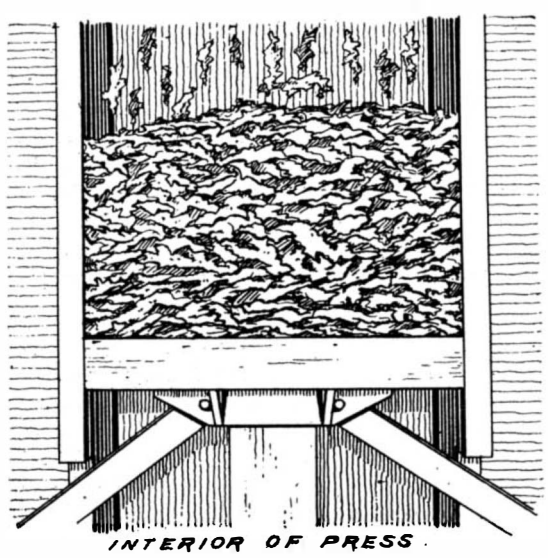
DUSTING RAGS



INTERIOR OF DUSTER



PRESSING RAGS INTO BALES



INTERIOR OF PRESS.

SEWING UP BALES.

PREPARING OLD WOOLEN RAGS FOR SHODDY CLOTHING.

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4 feet, with a pressure of about 20,000 pounds, making a compact mass of rags that can hardly be pulled apart. A piece of heavy red sheathing paper and bagging is first laid on the bottom of the press before the rags are thrown in, and another piece across the top when filled. These are bound tightly around the rags with steel wire when the bale is formed, the attendants then rolling it out of the press to other operators, who even the ends with the same material, The bagging is then sewed up around the bales, which are then ready to ship to the shoddy clothing manufacturers. Forty-two bales can be pressed daily, the operation taking about 15 minutes for each bale. The sketches were taken from the plant of the Jersey City Wool Company, N. J.

Excavations at Corinth.

The work of excavation at Corinth has now been going on for over two months and will cease for this year after ten days more of excavation.

The work this year was necessarily of a tentative character, and was limited to the digging of trial trenches. We started in absolute ignorance of the topography of Corinth, the one monument of the city that was above ground—the ruin of one of the oldest temples in Greece—having been hitherto without a name.

The area within the city wall, which is still well preserved in a part of its extent, is very large, measuring about two miles from east to west. Where within this area lay the agora, around which most of the temples and other important buildings were grouped, was a question to which archæologists gave different answers. If some point of the agora or some building, particularly the theater, could be found, then we would know that we were on the track of Pausanias, who describes the city with considerable fullness. With this hope we dug twenty trenches, some with cross and side trenches. Most of them are fifteen feet deep, and some more than twenty, going down in every case to the original surface.

In the last week we have come to a result which deserves to be communicated to the American public. We have achieved success in the very form in which we would have preferred to have it come. We have found the theater! This is to us just now more important even than a masterpiece of sculpture, because it marks the end of the trial stage of our excavations, and makes a natural close of our first campaign at the same time that it crowns it with success.

If one takes down his Pausanias he will see that one temple is above the theater and another adjacent to it, with other important buildings near by. It is now clear that what must be done is to lay bare an area including the theater itself and all its neighborhood. The day of trial trenches being passed, the earth must no longer be carried out of deep trenches in baskets, but a narrow gage railroad, with dumping cars, must be employed to carry off the earth in quantity to some little distance, as was done at Troy and as is being done at Delphi. Land also must be purchased, either by us directly or by the Greek government for us.

Both these things will make a demand upon those in America who are interested in such an enterprise.

It is fortunate that nowhere near the theater is a single house. What is to be purchased is simply land, and, fortunately again, quite poor land, and a considerable area can be bought for $1,000. It would be better, however, to have a larger area. It would be well for some public spirited American to make the American School of Classical Studies at Athens a land owner in old Corinth, for in that case the finds of the excavators, according to a law which is now under discussion and likely to be passed, would go to American museums.

It is not at all strange that in the kind of work which we have done hitherto no conspicuous finds have been made. The misses of the trial trenches at Olympia and on the Athenian Acropolis were more conspicuous than their hits. It was only when large areas were laid bare that the soil yielded up its treasures. So, doubtless, it will be at Corinth.

Not that our work has not yielded objects of minor value. Several pieces of sculpture, the best of which is a group composed of a youthful Dionysos, accompanied by Pan and a nymph; a quantity of very old and interesting bases, which any museum would be glad to have; a considerable quantity of most interesting vase fragments of old Corinthian style; many archaic terra cotta figurines; and several Roman inscriptions—these make up quite an important result.

But, after all, it is the finding of the theater that enables us to appeal to the American public to support this work generously. In the excavation of a great city like Corinth, the first object must be the recovery of the buildings. We were glad to find a grave with interesting prehistoric bases, but this was something thrown in—an accidental discovery. The archaic terra cottas which are now coming to light (one might say in a mass) above the theater are to us most important, as indicating the proximity of some ancient temple, in which they probably served as anathemata.

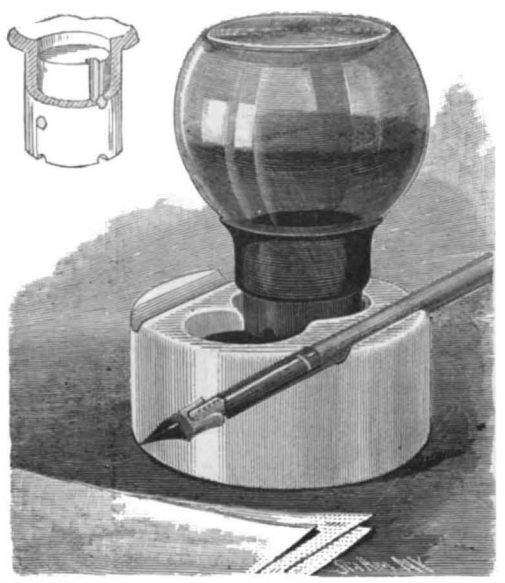
For months we have been at the heart of this most interesting ancient city of Corinth in various spots, but at such a depth that even when we seemed near important things we were not able to proceed to the right or to the left. In one of our deepest trenches we seem to have struck the agora itself; but certainty will have to be deferred to another year.

The year, then, ends with a result which is an earnest of greater results to come, and which establishes a claim on the generosity of our friends in America, on whom all depends.—Rufus B. Richardson, in the N. Y. Times.

A PNEUMATIC INKSTAND.

The very convenient form of inkstand shown in the accompanying engraving has been patented by Mr. Rollo M. Badger, of Sayre, Pa. The device consists essentially of two separate parts: a base formed of glass, porcelain, or any preferred material, and an inverted reservoir, which is preferably formed of glass, and is provided at its lower end with a circular neck, which is perforated with three or more holes distributed evenly around the periphery and arranged at different heights above the lower edge of the said neck of the reservoir.

The base of the inkstand, which is circular in shape, is provided with an ink well, as shown, which communicates with an annular groove in the base. The inner wall of said groove is formed by a plug or stopper which fits the circular neck of the reservoir, the neck fitting snugly but loosely over said stopper, and being adapted to turn about the same. A vertical groove or slot is formed on the wall of the stopper, as shown, and extends from the top to the bottom. When the reservoir is turned so that either of the openings in the neck coincides with the vertical passage above mentioned, the ink will flow from the reservoir down said passage, and escape through said opening into the ink well, until the level of the ink in the well rises high enough to close the opening. The holes in the neck being located at different levels, it is evident that the amount of ink in the well may be regulated by placing the desired hole opposite the vertical groove. When not required for use, the ink in the reservoir may be shut off from the outside air by turning the reservoir so that the vertical groove will be completely closed.



BADGER'S PNEUMATIC INKSTAND.

The Cost of War.

The Christian Work gives the following figures regarding the cost of war and the casualties caused by it:

In the last two hundred years France has spent £993,000,000 in war. Even Belgium spends every year 46,000,000 francs on her army. In less than three hundred years Great Britain alone has spent £1,357,000,000 in war. At Bannockburn 135,000 men fought, and 38,000 were killed or wounded. Italy spends every year 14,000,000 lire (£560,000) on her army and navy. The French army costs every year 675,000,000 francs; the navy, 209,000,000. The peace footing in the Russian army calls for the services of 170,000 horses. The army of Bolivia costs the people of that impoverished country £360,000 a year. At Gravelotte 320,000 men were engaged, of whom 48,000 were killed or wounded.

In a late number of Comptes Rendus is a report of M. Flammarion that, in the month of April, three new divisions in Saturn's ring had been observed between the Cassini division and the Crape ring, thus separating the inner bright ring into four zones. One of the dividing lines was more conspicuous than the other two, which were observed with difficulty, because of faintness. Such divisions have been observed before, and some of them, if not all, are due probably to the attraction of the planet's satellites. M. Flammarion concludes that the fainter divisions are variable and due to the cause just named.

Science Notes.

The Zopherus melicanus is the only known species of the American beetle that has strength enough in its mandibles to cut metal—a fact that was accidentally discovered by F. W. Devoe, says the Medical Age. Some specimens of this insect were sent him from Brazil, and being busily engaged at the moment of their arrival, he simply provided them temporary quarters in a glass jar with a pewter top. Within less than forty-eight hours they had cut holes in the metal sufficient to protrude their heads, and would soon have escaped had not their operations been detected.

In connection with its work on clouds, the Weather Bureau has issued a sheet giving illustrations of the typical cloud forms. The accompanying text contains descriptions of the clouds, and also data as to their mean heights and velocities. The sheet was prepared as an aid to observers in their cloud work. Most of the types selected are good, and the reproductions excellent as a whole. The altostratus and stratus are, however, unsatisfactory. The International Cloud Atlas, which has just been issued, gives us the cloud types selected by the International Cloud Committee, and these will, of course, now be the standard for the world.—Science.

E. A. De Schweinitz and M. Dorset find that the amount of crude fat in tubercle bacilli (see Ph. J. [4], 1, 179) is about 37 per cent of the weight of the dried germs. The fat, about 3·5 gm. of which was extracted from the microbes, yielded a hard soap on saponification with sodium hydroxide, and proved to be principally a glyceride of palmitic acid. In addition, it contains a minute amount of the glyceride of a volatile fatty acid, to which tuberculosis cultures owe their characteristic odor, and very small amounts of lauric acid (?) and an acid with an unusually high melting point, having apparently a larger carbon content than any acid previously noted in plants (Jour. Am. Chem. Soc., xviii, 449).

Dr. Ferdinand Ranwez has made use of the X rays to detect mineral substances added to saffron as adulterants. Out of four specimens so examined, only one was found to be pure; another contained 62·13 per cent of barium sulphate, and a third 11·75 per cent of that compound, together with a certain proportion of potassium nitrate. The fourth specimen contained 50 per cent of pure saffron, and the rest consisted of some substitute for that drug, faced with barium sulphate to the extent of 28·6 per cent. The plan adopted was to wrap a gelatino-bromide plate in black paper, place the saffron upon this on the same side as the sensitive film, then allow the rays to act for four minutes, afterward developing and fixing in the usual manner. The foreign matter is very sharply indicated in the print illustrating the paper, which appears in the Annales de Pharmacie for May.

An interesting case of mimicry in plants is described in the Botanical Gazette, that of the seeds of the "Philippine Island bean" from the coast near Manila, which so closely resemble the quartz pebbles among which they fall, in shape, size, color, luster, hardness and stratification, as to be indistinguishable from them except by a very close examination. The size and shape of the beans are both very variable, ranging from four to nine tenths of an inch in length; some perfectly resemble well rounded beach pebbles, while others mimic pebbles which have been broken across. Their color varies from moderately dark to light drab, some giving a faint greenish tinge; others resemble pebbles of chalcedony or of crystallized quartz. Nearly all the specimens show a series of approximately parallel darker lines passing round, very suggestive of stratification. All are quite hard, cut only with difficulty with a knife, and give a clinking sound when shaken together in the hand. They are not affected by soaking in sea water.

The last number of the American journal, Modern Medicine and Bacteriological Review, draws attention to a report recently drawn up by Prof. Conn, of the Western University, on the bacteriology of milk, published by the United States Department of Agriculture. Examinations of milk made at various places yielded numbers varying from 330,000 to 9,000,000 microbes per ounce. The milk supply of Boston was found to be particularly rich in microbes, as many as 135,000,000 germs being found per ounce. The Boston Medical and Surgical Journal lately reported a case in which a young man contracted tubercular disease by drinking milk from a herd of cows, 59 of which were afterward found to be tuberculous, while two persons employed in making butter from the same herd, and who drank large quantities of milk, also became infected. Although much has been accomplished in our country of late years to improve the sanitary conditions surrounding our public milk supplies, yet a great deal still remains to be done, and there cannot be a doubt that the next important step will be the distribution by our dairies of "pasteurized" milk and butter. The example has already been set by one important London dairy company, and it is to be hoped that others will follow what is, after all, but a tardy imitation of what has been done for some time past by our more enlightened neighbors on the Continent.

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Are Health Resorts Dangerous?

The Journal of Hygiene, in a recent number, says: "Forty years ago, Mentone was a happy village in France, where lived peasantry happy in their farms and in their superb physical state, conditioned by the climate. It was discovered that the region was a most healing one for consumptives, and it became the Mecca for the unfortunates of Europe so stricken. The inhabitants abandoned their farms to wait upon the strangers. The strong, healthy women forsook their dairies and became the washerwomen of the consumptives' clothes. No precautions were taken; the disease was not then understood as now, the theory of tubercle bacillus not having been discovered. The place today is bacillus-ridden, a pest hole, death itself. The hitherto strong inhabitants are emaciated, a coughing, bleeding people, filled with the germs of consumption. The soil and air are both contaminated with the tubercle bacilli. It is no longer a health resort."

The same fate, it is believed, awaits many other similar localities unless active measures are taken to destroy all germs. This will be a most difficult task, because consumptives themselves, as a rule, are not thoughtful of the danger they spread, or of the rights of others. They should bear in mind that if all the others had been careful, they, too, might have escaped.

Glass of the Fifteenth, Sixteenth and Seventeenth Centuries.

Foremost stands Venice, which, at the beginning of the thirteenth century, obtained workmen from Constantinople, and founded workshops that were in full activity till 1291, when they were all transferred to the neighboring island of Murano. During the fourteenth century the principal manufacture consisted of beads, imitation jewels, etc., which found a ready market in Asia and Africa. In the fifteenth century an impetus was given to the manufacture, arising from the capture of Constantinople by the Turks, and the revival of ancient art in Italy; the former throwing the glass trade almost entirely into the hands of the Venetians, while the latter furnished the artist with fresh and valuable sources of design. It was not, however, until early in the sixteenth century that the very beautiful process of which so many and such exquisite varieties are to be met with in private and public collections was discovered—a discovery which at first was religiously kept secret by the manufacturers themselves, and against the divulgence of which the Venetian government passed most stringent orders and threatened the severest penalties; while, on the other hand, the glass makers who remained faithful and silent, content with Murano, were made citizens of Venice on that account alone, the highest official positions being open to them; indeed, such singular honor was paid to them, that masters of the art were looked upon as little inferior in dignity to the highest nobles, and special and peculiar privileges were extended to them.

During the whole of the sixteenth and seventeenth centuries Venice was the principal glass manufactory of all Europe, at which every conceivable variety for use and ornament was produced. Early in the eighteenth century the Bohemian manufactures became noted, and the cut glass of that country caught Fashion's ever variable fancy. From that period the art gradually declined at Murano, and the privileges of the glass makers were annuled. Then came the decay of the republic of Venice, and its destruction by the French at the close of the eighteenth century; since which time, although the manufacture of glass is still carried on at Murano, its glory has quite departed, and its principal trade again reduced to beads and ornaments.

More even than for the exquisite beauty and delicacy of its contours and proportions, Venetian glass is celebrated for its ornamental patterns in latticinio, or milk-white threadwork, enamel, etc. The principal and most characteristic varieties of the manufacture were:

(1.) Subjects in white or stained glass, ornamented with enamel colors and gilding.

(2.) Glass ornamented with latticinio, or small milk-white threads, which, either milk-white or otherwise colored, are inclosed in the glass. These are spirally twisted into a charming variety of patterns.

(3.) Pieces in which two sheets of thin glass are conjoined, so as to form a network of latticinio or other colored threads, between each mesh of which a small air bubble is formed. The extreme delicacy, exactness, and minuteness of these pieces have defied all efforts at successful imitation. The variety was known as vitro di trina (lacework glass).

(4.) Mosaic glass, in which slices of colored threads or reeds were placed within two layers of white glass, and fused into masses ready for forming vases, etc. This kind has been very successfully revived in the present century. It was termed millefiore or vitro fiorito (flowered glass).

(5.) Glass in which minute particles of gold are arranged in patterns and fused, or in which metallic filings were dropped in the process of fusion, so as to form patches or specks of gold, etc., called aventurine.

(6.) Dark mottled glass, of various colors, fused and blended, which, when held to the light, shows a deep ruby color. To this species the German word schmeltze has been applied.

Other varieties were named schmelz aventurine, a combination of the last with the gold specks of the aventurine; frosted or crackle glass, and frosted glass with masks, flowers, etc., blown in relief on it from within.

These are some of the principal processes found in old Venetian glass, which, besides the elegance of its forms already noticed, is remarkable for some most grotesque and curious designs in the shape of animals, fishes, nondescripts, etc., which are stated to have been chiefly in use for chemical purposes. Some of the foregoing processes have been imitated in other countries, but Venetian glass far surpasses them all in the beauty and variety of its outlines and the fragility of its material, which was of so delicate a nature that it was believed if poison were poured into certain of the finest specimens, the glass would break.

Germany, during the sixteenth and seventeenth centuries, manufactured a number of large glass goblets, ornamented with armorial bearings, figure subjects, foliage, and inscriptions in enamel colors, which afford much interest and information on contemporary events which commemorate the purposes for which they were often specially made.

Engraving on glass, though commenced with the diamond point by the Venetians in the sixteenth century, was carried to greater perfection by machinery in Germany, France and Holland, from the seventeenth century to the present time. Etching on glass by means of a powerful acid was also practiced in the seventeenth century, the discovery being attributed to Schwanhard, of Nuremberg, whose secret, however, died with him.

The first manufacture of glass established in this country appears to have been in the year 1557, at the Savoy House, in the Strand. In 1635 a patent was granted to Sir Robert Mansell for glass making, but it could not have been on any large or important scale, as the same patent empowered him to import Venetian glass. In 1670 the second Duke of Buckingham induced some Venetian workmen to settle in London, but ornamental glass making never prospered, and it was not until the present century that the higher branches of decorative workmanship have been successfully practiced, and their application extended to a great and increasing variety of subjects.

It may be remarked that in the arts of glass making, pottery and metal work, the East preceded and excelled the West in works of industrial art.—The Pottery Gazette.

Respirability of Air in which a Candle Flame is Extinguished.*

At the last meeting of the British Association the author stated the composition of artificial mixtures of nitrogen and of carbon dioxide with air which were just able to extinguish various flames. It was found that the flames of ordinary candles and lamps were extinguished by mixtures which contained on an average about 16·5 per cent of oxygen and 83·5 per cent of the extinctive gases. A flame of coal gas, however, required for its extinction a mixture still poorer in oxygen, and containing 11·3 per cent of oxygen and 88·7 per cent of the extinctive gases. These results have since been confirmed by a different method.

The method consisted in allowing the flames to burn in air inclosed over mercury until they were extinguished; the remaining extinctive atmosphere was then subjected to analysis, when its composition was found to be practically identical with that previously obtained from the artificial mixtures. An analysis of air expired from the lungs proved that it was also of the same composition as that which extinguished the flame of an ordinary candle or lamp. The average percentage composition of expired air and of air which extinguishes a candle flame is as follows: Oxygen, 15·9; nitrogen, 80·4; carbon dioxide, 3·7.

Now an atmosphere of this composition is undoubtedly respirable. Physiologists state that air may be breathed until its oxygen is reduced to 10 per cent. The maximum amount of carbon dioxide which may be present is open to question, but it is undoubtedly considerably higher than 3 per cent. Dr. Haldane maintains that the above atmosphere is not only respirable, but could be breathed by a healthy person without inconvenience of any kind; he further states that no permanent injury would result from breathing such an atmosphere for some time.

The conclusion to be drawn from these facts is that an atmosphere must not be considered to be dangerous and irrespirable because the flame of an ordinary candle or oil lamp is extinguished by it. The view is very generally advanced that a man must on no account venture into air which extinguishes the flame of a candle or of a bundle of shavings. It will be seen that this precaution may deter one from entering an atmosphere which is perfectly safe and respirable, and from doing duty of a humane or necessary character. An atmosphere which extinguishes a coal gas flame, however, appears to approach closely to the limit of respirability, as far as the proportion of oxygen which it contains is concerned. Hence the coal gas flame appears to be a more trustworthy indicator of respirability than the flame of a candle or oil lamp. Undoubtedly the candle and lamp flames should be discarded as absolute tests of the respirability of air.

*By Frank Clowes, D.Sc.—From the Engineering and Mining Journal.

Etiology and Pathology of Obesity.

Edgar Thompson, M.D., translates from L'Union Med. for the Medical Review the following as to the cause of obesity. As a general rule, obesity is more frequent in cold climates than in hot. The inhabitants of the extreme north are very fat from the great absorption of fatty foods, oils, etc. This superabundance of food with the increasing use of alcohol and a more indoor life is favorable to the production of fat.

The inhabitants of the torrid zone who live on a scant fruit diet and exercise constantly in the open air rarely fatten.

All authorities agree that alimentation plays a strong role in obesity, but the opinions as to the particular foods are not unanimous.

In the normal nutrition the fats introduced in the alimentary canal are broken up into glycerine and fatty acids, and the greater part is oxidized in the organism—body heat resulting from the combustion. The small amount which escapes immediate combustion accumulates in the various tissues and constitutes a reserve which can be utilized when the supply of fat, from without, fails. If the amount of foods are superabundant, or if their oxidation is incomplete, the equilibrium will be lost, and the fat will accumulate in the cellular tissues, causing obesity.

The inordinate use of albuminoids can contribute to obesity. Lean meat gluttons get fat. In the physiology of nutrition the albuminoids can be transformed into derivatives identical with fats and hydrocarbons. These fatty bodies arise when more albuminoids are presented than can be completely oxidized into urea, etc.; the surplus is incompletely oxidized into the fats.

Fat can also be formed from hydrocarbons (sugars). One part is oxidized in the organism, while the rest is transformed into fat (Liebig). Selon Beauniz explains the formation of fat in connection with hydrocarbons in a different way. He suggests that the hydrocarbons are not changed into fat at all, but being more easily oxidized than the fat in foods, they will be taken up for combustion in preference to the latter, and all of the ingested fat will, therefore, accumulate unchanged, producing obesity.

The author concludes that all kinds of foods can produce fat. Beverages can influence the deposition of fat. It is generally admitted that water, taken in large amounts, favors corpulency. Dancel's treatment of obesity is to limit the water drank by the patient. The alcoholic obese bloat is proverbial. Alcohol causes the accumulation of fat by limiting its oxidation. The alcohol acts as an easily combustible food and displaces the fatty foods by reason of its greater affinity for oxygen. This habit can be a cause of obesity.

Lack of muscular exercise hinders the oxidation of the fats as well as the other nutritive metamorphoses. Sedentary habits have a similar effect. In the female, obesity has a close connection with certain phases of genital life. Some women fatten immediately after marriage; others become obese after pregnancy; others still, after the menopause.

Frequently obesity develops from an accidental cause, change from an active to a sedentary life promotes it; sometimes it occurs after an acute febrile disease, as pneumonia and typhoid fever. All those nutritive changes which hinder the oxidation of fats promote obesity.

A Living Fossil.

Prof. Denny recently gave a demonstration to his students at Firth College, Sheffield, England, of a very unusual and interesting nature, says the Westminster Gazette. Among the most ancient of animals still inhabiting our planet is the so-called mud fish (Protopterus) of Africa—a creature worthy of our respect, if only in consideration of its vast antiquity, which dates far back in the early ages of the world. Of popular interest, the most striking feature of the mud fish is the possession of lungs as well as gills. On the approach of the dry season, in its natural haunts in Central Africa, the mud fish hollows out a chamber in mud, and enters upon a period of rest extending over many months, during which time it is without access to water, and breathes air only. While in the mud these fishes may be dug up, and survive even after a journey across the world in the dry state. Prof. Denny received a short time ago one of these mud blocks. In the presence of the students the hard block was placed in warm water, and after being thus exposed for nearly two hours the fish, which went to sleep in tropical Africa many months ago, awoke and came forth from its temporary sepulcher to find itself in a bath of tap water in the biological laboratory of Firth College, where it is now alive, and doubtless happy.

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ACCURATE MEASUREMENTS.

In many machine shops and manufactories where $\frac{1}{16}$ inch or $\frac{1}{32}$ inch is considered close enough, it is not realized what degree of accuracy is meant by half or quarter of a thousandth of an inch. There are, however, a great many shops and manufactories, as well as government machine construction shops, in which one-half or one-quarter of a thousandth of an inch is spoken of as a quantity of considerable importance.

In modern machine tool building, graduating of scales, etc., the call is for greater accuracy, and machines have been designed to meet this demand.

Accurate readings from a micrometer caliper can be made to $\frac{1}{10\,000}$ of an inch; from this one is able to judge with what care the parts of such an instrument must be made, as a slight inaccuracy in any one of the parts will oftentimes throw the others out of adjustment, and impair the result.

Expensive special machinery of great accuracy is necessarily required for this class of work. These machines have been the outgrowth of long experience and the constant application of some of our best mathematicians. The final testing of a caliper of the kind mentioned above must be made with the most delicate instruments, or with standards made to exact size.

The accompanying cut shows the measuring machine, one of the numerous appliances for securing great accuracy peculiar to the shops of the Brown & Sharpe Manufacturing Company, of Providence, R. I., and used for the measuring of standard gages, and other tools that must be finished to exact size.

One of these machines was exhibited at the World's Fair, at Chicago, where it was shown publicly for the first time. The base of the machine consists of a massive bed 18 inches high. On top of this bed there are two movable heads, fitted to the broad flat surface, and gibbed at the sides. The large head, shown at the left, carries a bar having a finely graduated scale, graduated to fortieths of an inch, fastened to the upper side. The graduations on the inner side of the scale are so fine as to be nearly invisible without the aid of a glass. Above this scale is a microscope, fitted with a micrometer eyepiece, for reading the graduations: the microscope is mounted upon a slide parallel with the scale. By the use of this slide the capacity of the machine is 16 inches in length.

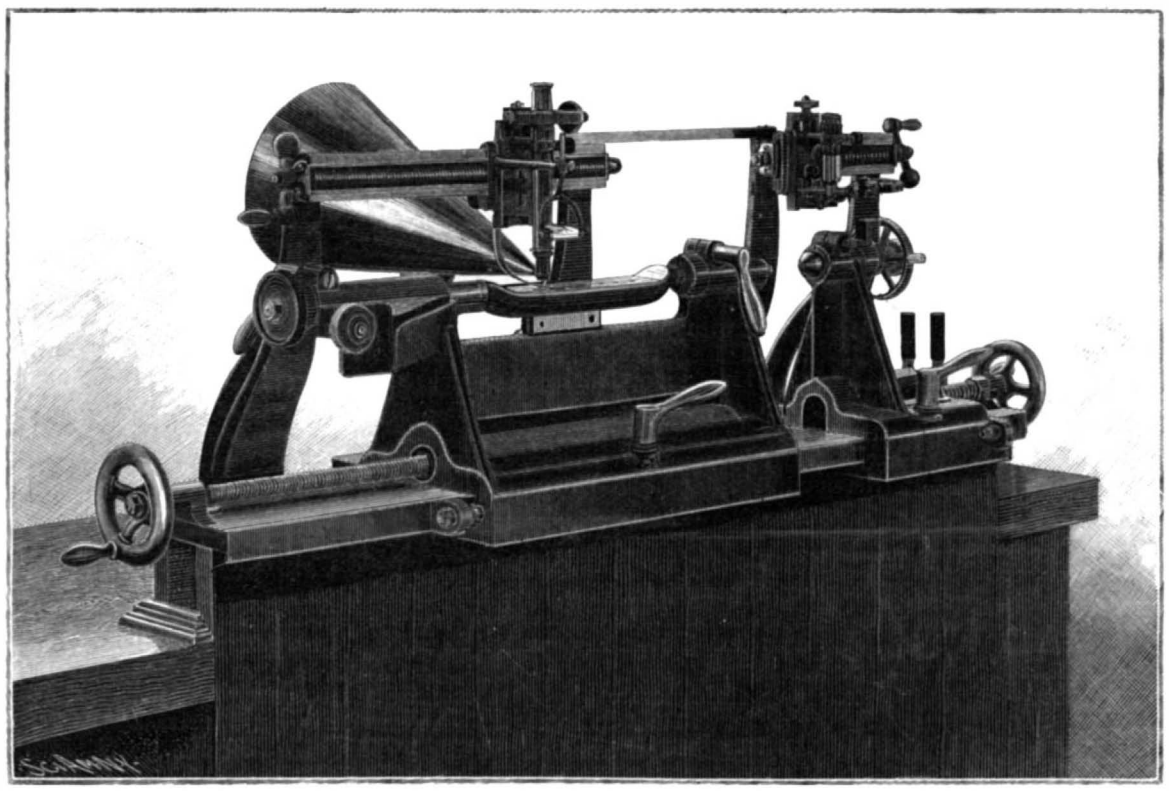
On the smaller head, shown at the right, also movable, is a micrometer screw. The micrometer graduations are read by means of a vernier scale, making the value of the graduations equal 0·00001 of an inch.

The cone shown at the back of the machine is for the purpose of concentrating the light upon the graduations of the scale.

The chief adjustment of the machine is made by the adjustment of the hair line of the microscope coincident with the lines of the finely graduated scale. The other measuring point is placed by means of the micrometer screw in the head at the right of the machine.

In taking a measurement the machine is first adjusted to a point on the finely graduated scale corresponding to the nearest 40th to the size to be measured. Distances less than $\frac{1}{40}$ of an inch are obtained by means of the micrometer screw.

Measurements may be made on this machine to 0·00001 of an inch, and with ordinary care measurements may be made of variations not exceeding 0·00005 of an inch. In the same class of appliances is the Odontom engine for milling templets and for making cutters for the teeth of epicycloidal gears with the curves theoretically correct. The variations left by the milling cutters made from these templets do not exceed 0·001 of an inch. A standard yard, used for reference, may also be considered one of these appliances.



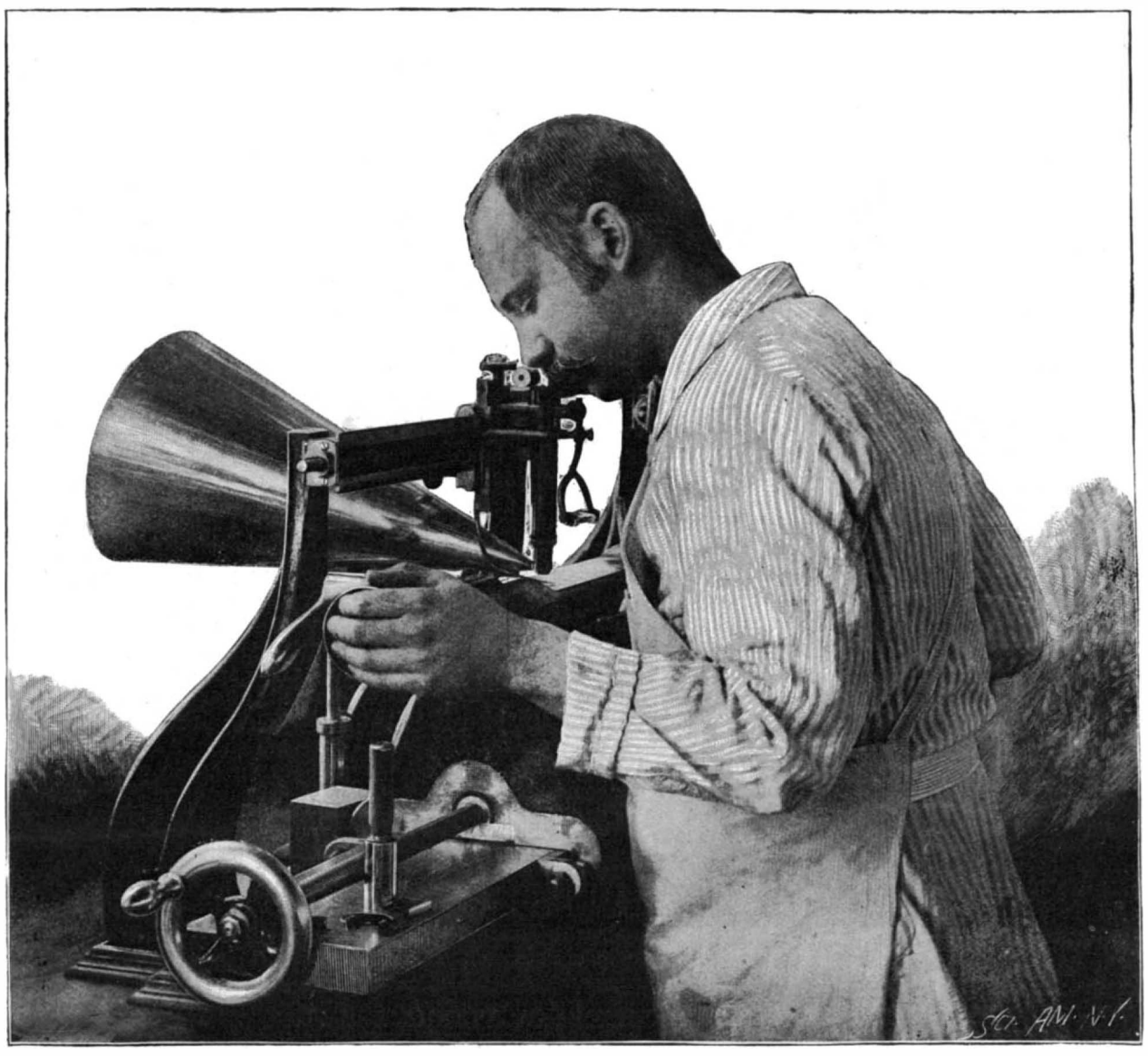
MACHINE FOR MEASUREMENTS OF GREAT PRECISION.

X Rays and the Aurora Borealis.

A series of experiments of the greatest interest, relative to the action of a powerful magnetic field upon the cathodic rays in Crookes or Hittorf tubes, has been undertaken by Mr. Birkeland, who has published the results thereof in the Elektroteknisk Tiddskrift, of Christiana.

These experiments show that in such a field the cathodic rays are considerably deflected in the direction of the lines of force and may even be concentrated upon the surface of the glass to such a degree as to cause the fusion of the latter. Much more than this, they clearly prove that the rays that emanate from one and the same cathode fall in groups whose physical constants are connected by some definite law, just as are the frequencies of the different tones emitted by a rod in vibration.

These researches present some importance as concerns the theory of the aurora borealis. As well known, Mr. A. Paulsen, the learned director of the Meteorological Institute of Copenhagen, claims that the aurora borealis owes its origin to the phosphorescence of the air produced in the upper regions of the atmosphere. Mr. Birkeland puts forth the idea that terrestrial magnetism may be the cause of such phosphorescence, which becomes intensified in the vicinity of the terrestrial poles.—L'Electricien.



BROWN & SHARPE MEASURING MACHINE IN USE.

The Quinquennial Census of London.

The result of the census, taken for the purpose of ascertaining the number of persons present within each parish in the administrative county of London, on the night of Sunday, March 29, has not yet been officially declared, but we believe the return will show an increase of 221,000 in the population of the prescribed area since the census of 1891. At that date the population of the administrative county, which includes the hamlet of Penge, was 4,232,118. We may, therefore, reckon that the total was raised at the close of March last to something like 4,453,000. When the census of 1891 was taken, the population of Penge was found to be 20,375. In 1894 it was estimated by the registrar-general at 20,589, showing, therefore, a small rate of increase. If we add the whole of the quinquennial increase of the administrative county to the population of London, as shown in 1891, we get a total of 4,432,743.

The registrar-general has estimated that the population of London, by the middle of the present year, would be 4,435,955. But there is a gain of three months in this reckoning, owing to the circumstance that the national census is taken at the commencement of April, or three months earlier than the midsummer epoch. As there is an increase of more than 43,000 in the population of London in a year, the three months' deduction will bring down the estimate to 4,425,000 for March last, or a quinquennial increase of a little over 213,000. It happens that, if we take the increase estimated by the registrar-general for each year from 1891 to 1895, both inclusive, thereby constituting a quinquennial period, the increase becomes 212,593.

The recent census seems to show a more rapid growth. —London Standard.

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Dark Light.

The claims of M. Gustave Le Bon, a French physicist, to have discovered what he terms "dark light"—an invisible form of radiation arising from the passage of ordinary light through apparently opaque metal plates, and capable of producing shadowgraphs like those of the X rays—have already been noticed in these columns. M. Le Bon's experiments have been described before the French Academy of Sciences, a sufficient proof that they have been performed in good faith; but his conclusions have been usually looked upon with suspicion, men of science having generally thought that he has been deceived by the filtration of light through chinks in his plate holder, or by some similar action. Nevertheless, his experiments and papers continue, and in his last paper, read on May 11, he asserts that many forms of invisible radiation, including Roentgen's X rays, rays from fluorescent bodies, the rays discovered by himself as noted above, and others, are all merely forms of "dark light," which term he thus widens in application to cover all kinds of radiation capable of affecting a photographic plate, but not the retina of the eye. Le Bon's experiments have been unaccountably neglected in this country. They are so simple that it should be easy for almost any one to prove the truth or falsity of his claims, yet no one apparently has thought it worth while to take the trouble. One American scientific magazine of high repute even refers to his experiments as experiments on X rays, says the Literary Digest. It is quite certain, however, that there are forms of invisible radiation capable of taking a photograph, besides the famous X rays. Some of the methods of photographing "in the dark" were known, in fact, long before Roentgen's discovery. It may be that Le Bon has really discovered a new and related form of radiation, and in any case his recent classification of all such forms under one comprehensive head is a step in the right direction. We translate below an extract from the paper alluded to above, together with an abstract of other portions of it, from Cosmos (Paris, May 23):

"To place his previous experiments definitely beyond all the objections brought against 'dark light,' notably that which suggests the filtering of ordinary light through the cracks of the plate holder, M. Le Bon has undertaken new experiments with the object of condensing it on the surface of metal plates, and then obliging it to pass through these and act on photographic plates in darkness. We quote from his communication the description of his experiments:

"'Take a sheet of copper and one of lead, about one millimeter in thickness; place each of these two sheets in a photographic printing frame instead of the sheet of glass and expose one of the faces—one only—at a distance of 20 centimeters [8 inches] to the light of an electric arc, for one hour. Remove the two frames to darkness and allow them to cool for two hours. Remove the sheets from their frames; then, between the two faces that have not been exposed to the light, place a sensitized glass plate, and the object that we wish to reproduce, a photographic negative for instance, taking care that the object shall be between the copper and the sensitized plate. To avoid all contact action, be careful to separate the sensitized glass from the object to be reproduced, by a sheet of glass or celluloid. It will be sufficient to leave the whole in darkness for five or six hours, to obtain on development a perfect image of the object placed between the metal sheet and the photographic plate. It is then evident that the light condensed on one of the faces of the sheet of copper has traversed the metal and made an impression on the photographic plate.'

"Adopting the term 'dark light' for all forms of invisible radiation hitherto discovered, M. Le Bon believes that he has been able to establish the following classification:

"X Rays.—These traverse black paper and organic substances, do not pass through most metals, and are neither reflected nor refracted.

A HUT IN PROCESS OF CONSTRUCTION.

"Invisible Rays from Fluorescent Bodies.—These pass through metals, as Messrs. D'Arsonval and Becquerel have shown, are refracted and reflected, and present, consequently, no peculiarity permitting us to identify them with the X rays.

"Rays that are Formed when Visible Light Falls on Metallic Surfaces.—The researches of M. Le Bon show that these rays do not pass through black paper, nor through the greater part of organic substances, but that they pass through a large number of metals. They also possess the property of being condensed and diffused, like electricity, on the surface of metals.

"Rays Belonging to Organic Beings.—Rays are emitted by organized beings in darkness, which allow us to photograph them, as M. Le Bon has shown by operating on ferns, fishes and various animals. These rays appear to be related to the invisible rays of phosphorescence, but they differ nevertheless in that they do not pass through metallic bodies, at least those experimented upon—notably aluminum."

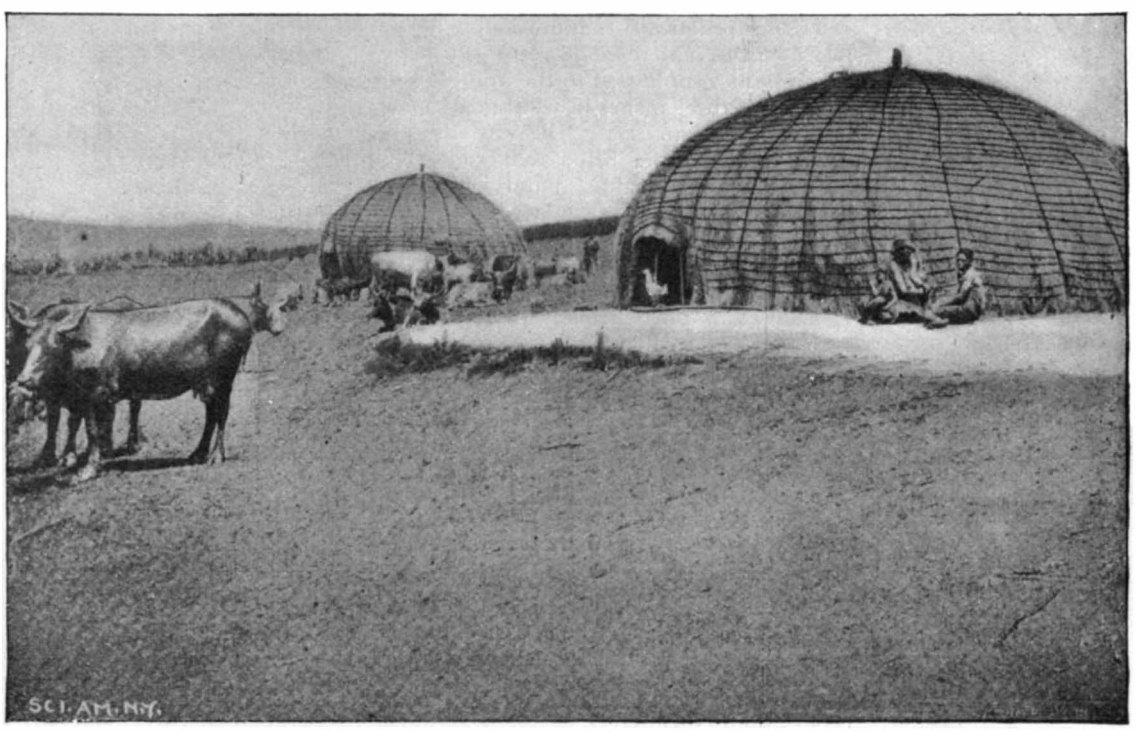
COMO, in Italy, is the birthplace of Alessandre Volta, and will celebrate, in 1899, the hundredth anniversary of his invention of the voltaic battery by an electrical exhibition and congress.

THE MATABELES AND MASHONAS.

BY P. LEMOSOF, IN MAGASIN PITTORESQUE.

Matabeleland and Mashonaland form part of British Zambezi or Rhodesia, as it has been named from Cecil Rhodes. Various conventions with the neighboring powers have assured to England the possession of this vast country extending northward from Cape Colony, and which a privileged company—the Chartered Company—has tried to render valuable. The results thus far obtained by no means correspond to the amount of money and labor expended in the exploitation of the country; for, although some parts of the territory, in the neighborhood of the rivers—like that in the neighborhood of Senna shown in our engraving—present a real tropical beauty, the greater part of Zambezi is arid and barren, its only riches being a few auriferous veins which scarcely repay the cost of the first installation; and furthermore, it is very difficult to establish trade with the natives, especially with the Matabeles, who are supposed to belong to the most refined tribe of the Kafir races. Imperious, warlike, accustomed to maintain themselves by their raids on neighboring tribes, Matabeleland was, until a few years ago, a very powerful realm. The chiefs of all of these South African tribes, the Mashonas, the Matabeles and the Zulus, enjoy a real authority in spite of their air of indifference and physiognomies which offer so little that is attractive in the eyes of white men, and for this authority there is fierce contention among the descendants of a deceased chief.

Like the ancient feudal lords, African princes usually obtain supremacy over their people only at the price of the blood of their opponents. The reign of the last monarch of the Matabeles, Lo Benguela, was inaugurated by the massacre of all of his brothers. It is true that he was encouraged in this particularly by his sister Njina, who hoped also to gain power, but having, in her turn, been accused of casting a spell over the queen, rendering her barren, the tender sister was condemned to death and hung from a tree on April 2, 1880. It is thus seen that the women of these countries play a certain part, in spite of the state of servitude endured by the "weaker" sex among all primitive races. The distribution of work is often quite the reverse of that which we are accustomed to see among civilized people. On the shores of the Zambezi, especially where the breeding and raising of cattle is impossible on account of the ravages of the fly tze-tze, agriculture constitutes the only occupation of the inhabitants. The work of the fields falls entirely upon the women, who start off early in the mornings to cultivate the ground and raise the grain and corn. Millet or sorghum, called mabele by the Matabeles and imphi by the other tribes, constitutes their principal food. The cooking is carefully attended to by the men who remain in the village, and they also take care of the household arrangements. After the return home the members of the family assemble around the pot, into which each one dips his five fingers and makes a ball, which quickly disappears down his throat. This is the one meal of the day. They talk often until very late at night, all smoking the daga, a kind of native tobacco, after which all go to bed, either inside of the huts or in the open air, rolled in a sheepskin.



MATABELE HAMLET.

From photographs supplied by the Société de Geographie.

Contrary to the practice among other African races, the Matabele women are subjected to a most austere

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regime, such as is almost unknown among other primitive peoples. Any immorality, especially of young girls, is severely punished, and European travelers have seen young people instantly put to death for such offenses. This severity is much relaxed in regard to their relations with whites, the birth of a halfbreed child giving prestige to the mother.

The dwellings of the Matabeles, as well as those of the Mashonas and other Kafir races of Southern Africa, vary according to the importance of the tribes and the positions of the occupants. Those intended for the masters are generally round, spacious, with an opening serving for a door by which admittance is obtained to the kraal or inclosure reserved for the members of the family. All are made of reeds or bamboo. Some of the tribes give a certain elegance to the construction of their houses, which are square and thatched, recalling the isbas of the Russian peasants. The huts occupied by the servants and slaves are, on the other hand, nothing but miserable kennels, often much dilapidated, and for a door there is only a hole at the base of the hut, which can be entered only by crawling in.

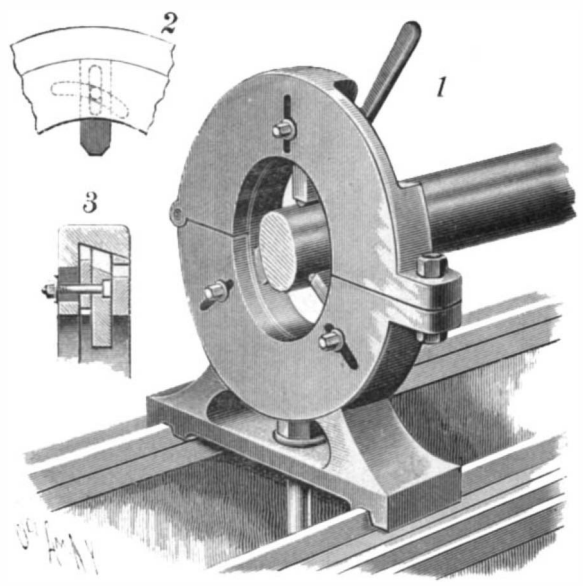
A slow transformation, however, is taking place in the lives of these people, as European civilization penetrates into their country. The "Chartered Company," often decried, has already accomplished considerable work: roads have been made, railroads built and exchanges established where the natives become familiar with European products, the need of which they begin to feel more and more. Who knows but these grown-up children, gay, unconscious, naive rather than perverse, may render a great service to humanity by trying to fertilize the immense tracts which are still uncultivated and which can be transformed into productive land only by the labor of man?

A NATIVE MEAL.

A SOUTH AFRICAN PRINCE.

A NEW STEADY REST FOR ENGINE LATHES.

A handy form of steady rest, so arranged as to facilitate the lining up of work in the lathe, has been patented by Mr. John H. Blum, of the Western Iron Works, East Second Street, Butte City, Montana. The stand is made in two halves, which are hinged together, and secured by a bolt at the free ends; the base being adapted to slide longitudinally on the bed of the lathe, and to be secured thereon by a suitable clamp, as shown in the accompanying illustration. The stand is annular in shape and is accurately turned to receive an annular jaw carrier, whose periphery is



BLUM'S STEADY REST FOR ENGINE LATHES.

beveled and rotates snugly in contact with the stand.

In the jaw carrier are a number of radial grooves, in which the jaws that engage the work are fitted to slide freely. Each of the jaws carries a bolt, which extends at right angles to the jaw, and passes through a cam slot formed in a flat ring which is mounted to turn in a circular recess formed on the inner face of the jaw carrier. These bolts also pass through radial slots formed in the back of the stand. The ring is provided with a handle, by the operation of which the bolts and the jaws to which they are attached are caused to travel in the cam slots and are given a radial motion to or from the work in the lathe. By this means the jaws are simultaneously moved in to engage the work, and the jaw bolts having been tightened up, the work so engaged is held in the center of the rest. If it is desired, the jaws can be provided with rollers as shown in the illustration.

Extraordinary Skin Grafting.

Dr. Nicholas Senn has made a success of an extraordinary operation in skin grafting, says the Chicago Times-Herald. Nothing of the kind was ever tried before, and the eminent Chicago surgeon has startled his medical brethren again by his daring, and is receiving their plaudits for the triumph of his remarkable experiment.

The parboiled hand of a man, devoid of skin on its back, was inserted in a puncture made between the skin and flesh of the man's own stomach and fastened there for three weeks, literally in a sling of skin and flesh. When it was removed it was found that the skin of the stomach had grown to the back of the hand. It was carefully treated, trimmed down to where it should grow, and a triumph in the surgery of skin grafting was made public.

The patient is E. E. Lyday, cashier of the First National Bank of Newton, Iowa. He has been a resident and business man of that place for years. Mr. Lyday was a victim of a wreck on the Chicago, Rock Island and Pacific Railway at Grinnell, Iowa, in 1894. The hot air pressure on a coach at that time severely scalded his face and hands. He was scarred for life. In the course of time he recovered the use of his left hand, but his right hand was so parboiled and maimed that he lost control of it. The member was like a piece of mangled beef. The skin was hopelessly and permanently gone from finger tip to wrist.

Being possessed of means, Mr. Lyday sought the best of surgical aid regardless of expense, but without avail until recently. Several weeks ago he came to Chicago and went to St. Joseph's Hospital. Dr. Senn was summoned.

The surgeon found that the hand baffled all old remedies at grafting. He finally decided to make an experiment as the last hope for relief. Lyday shuddered at the suggestion, but pluckily agreed to the test. Dr. Senn decided that the chance was to slice a piece of skin in Lyday's breast or stomach so that the hand could be inserted therein between the flesh and skin, thus practically making a sling of skin and flesh, in which the patient could rest his disfigured hand.

Lyday first submitted to the knife April 25. A piece of his skin three inches in width, five inches long and one-quarter of an inch thick was skillfully cut. The unique bandage was lifted to permit the insertion of the mangled and scalded hand which needed a new covering. The hand was placed in this novel grafting device. The triumph was complete. The skin had grown on the back of the hand, and a process was promptly applied to substitute another skin on the stomach and breast from which the strip had been transferred to the hand.

A photographer took advantage of the opportunity, and several good negatives of the achievement were secured. Mr. Lyday is in excellent spirits, and Dr. Senn naturally is proud of the success of his novel experiment.

The Bicycle Among the Savages.

Oscar Tomare, the prince of the island of Bora Bora, one of the largest of the Society Islands, in the South Pacific Ocean, arrived recently in San Francisco from Scotland, where for the last five years he has been taking a course in English. The prince is a tall, dark young man, about twenty five years of age, with a pleasant, affable manner. He was a nephew of the late King Pomare, the last ruler of the island of Tahiti, and a cousin of Queen Mamea, who was recently dethroned as the sovereign of the rebellious natives of Raiahtea.

When Prince Tomare left his home in the islands five years ago, he could not speak a word of English, but now he converses, not only in the Anglo-Saxon tongue, but in French and German as well. He is an advanced student in political economy, and spent nearly a year in studying art in Paris, where his oil paintings received very high commendation.

"I went to Scotland to be educated," said the prince to a representative of the San Francisco Examiner, "because a great many of the young men of the royal families in the South Sea Islands were educated there. Arthur Brander and John Brander, both friends of mine, were educated in that country. I was a student at the Edinburgh University. The rules are very strict, and so are the professors, but it is all for the best; you learn a great deal more.

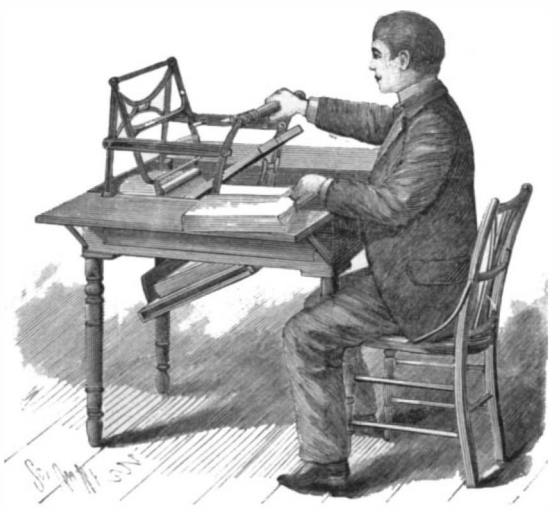
"I have been all through Europe—France, Germany, Great Britain and Greece—but there is no country that shows such a great amount of enterprise as America. New York, I think, is the greatest city in the world, and San Francisco is the prettiest. I am not a stranger, for I stayed here a month when on my way to Scotland.

"I am a confirmed bicyclist and ride whenever I get a chance. I believe I would have ridden out here from New York if the roads had been good. On Monday I am going down town to purchase twelve wheels to take home with me for the members of my household and my family. They will be the first wheels to be introduced in the islands, and I know the natives will be astonished when they see them. It will be funny to see a lot of men and women with nothing on but pareus (native body cloths) riding around on bicycles among the banana trees."

AN AUTOMATIC DUPLICATOR.

The Neostyle Company, of 100 Church Street, New York, for the past ten years manufacturers of neostyle duplicators, have just placed upon the market the automatic neostyle, a machine which, owing to its efficiency and simplicity, and to the admirable work it performs, will be found a convenient adjunct to any office.

With the automatic neostyle an original is written either with the neostyle pen or ordinary typewriter on a sheet of patented stencil paper. The stencil is then laid on the printing platen, and a slight movement of the lever causes the frame to close, then the stencil is automatically held in the printing frame. All that is now necessary to do is to feed the machine and operate the lever. The ink is fed automatically, the supply being regulated by a small thumb screw. Copies can therefore be light or dark, according to the ink that is allowed to flow (a thousand copies can be taken without touching the ink fountain). This ink, as soon as it is deposited on the plate, is taken up automatically by two rollers which distribute it evenly, the ink plate revolving a quarter of a turn at each impression. The movement of the lever brings the printing roller across the stencil, the pressure being regulated automatically, thus insuring an even copy. As soon as copy is taken the movement of the lever is reversed, the frame opens and the sheet is discharged automatically. A simple indicator shows the number of copies printed. The machine can be made ready or closed up in five seconds, without disconnecting a single part.



AN AUTOMATIC DUPLICATOR.

IN the year ending May 10, 1896, photographs of the sun were taken at Greenwich with the Dallmeyer photoheliograph, mounted on the terrace roof of the south wing of the Physical Observatory, on 229 days, and of these, 459 have been selected for preservation, besides 14 photographs with double images of the sun for determination of zero of position angle. For the year 1895, Greenwich photographs have been selected for measurement on 249 days, and photographs from India and Mauritius—filling up the gaps in the series—on 113 days, making a total of 362 days out of 365 on which photographs are available.

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RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR FENDER.—Oscar L. Whitney, Cambridge, Mass. The object of the invention is to improve that class of fenders consisting of a horizontally projected buffer, adapted to receive the person or obstruction run down by the car, and to provide such fender with improved mechanism whereby persons and obstructions falling under the fender may be saved from contact with the wheels or other portions of the car. The invention consists of a combination of the longitudinally slidable fender, the drop catcher supported thereon so that the catcher will be moved bodily rearward in unison with the fender in case of a collision, a supporting device for holding the catcher in an elevated position, and mechanism for releasing the catcher.

CAR FENDERS.—Octavius A. White, New York City. The invention relates to improvements in car fenders. The object is to produce a very inexpensive and simple apparatus of this kind, which may be conveniently applied to a car, and in which oppositely revoluble drums are employed, these being arranged so that in case a person is run down by the car he will be thrown to one side of the track and thus saved from serious injury.

Mechanical.

CRUSHING MILL.—C. M. Carhart, Plainfield, N. J. The machine, which is simple and effective, has for its leading features circular toothed dies, which are engaged by rotatable toothed roller stamps. The carriers for the roller stamps are given concerted rotary movement and the roller stamps independently rotate upon their carriers, whereby a striking action is obtained for the stamps. The impact of the stamp rollers upon the dies thoroughly crushes the material supplied to them, and the contact face of the stamps and dies are so formed as to retard the material, insuring its proper pulverization. A cushion is provided between the dies and frame of the machine, which prevents the latter from being unnecessarily jarred. The pulverized material is delivered by centrifugal action to an amalgamating surface from which the refuse passes off through a suitable conductor.

DEVICE FOR MOVING GRAIN.—Edwin C. Harnden, Carbondale, Pa. The object of the invention is to provide a new and improved device for moving grain from one place to another, the device being very simple and durable in construction, very effective in operation, and more especially designed for unloading grain and other loose material contained in cars. The invention consists principally of a removable drum, a pulling rope adapted to wind on said drum and connected with the scoop, shovel, or like device for moving grain, a clutch mechanism for throwing the drum into and out of gear, and a controlling rope adapted to wind on the said drum and under the control of the operator, said controlling rope controlling the clutch mechanism.

PRESS.—Peter Bartoletti, Monongahela City, Pa. The object of the invention is to provide a new and improved press for forcing plastic material into moulds to form articles of various shapes, the press being, however, more especially designed for rapidly making ordinary clay cylinders. The invention consists principally of an intermittently revolving table carrying moulds having movable bottoms, a box arranged over said table and provided with a reciprocating plunger for pressing the material into the moulds, and a fixed cam for moving said mould bottoms, to push the pressed article out of the mould.

ORE SAMPLER.—Thomas A. Topham, Aspen, Col. The object of the invention is to provide a new and improved ore sampler which is simple and durable in construction, very effective and accurate in operation, and arranged to cut out samples from a quantity of ore to accurately represent the contents of the whole. The invention consists of a wheel mounted to rotate at a high speed, and provided in its web with a chute extending from the back of the web to the front thereof and in an outward direction, to cause the ore entering the chute near the center of the wheel and at the bottom of the web to be delivered by centrifugal force to the front of the wheel.

TROLLEY FOR KITES.—Thomas J. Rogers, Jacksonville, Ill. The invention relates to a toy which is in the nature of a trolley, it being adapted to travel on a string attached to a flying kite, and the object of the invention is to provide the trolley with wings which when spread will serve to carry the trolley up the kite string by the pressure of the air on the wings, and furthermore to so construct the trolley that a parachute, balloon, or any equivalent small object may be carried upward by the trolley, and whereby when the trolley approaches the bowstring on the kite a trip will be operated which will permit the wings of the trolley to close and at the same time release the object carried upward by the trolley, permitting it to drop to the ground. When the wings of the trolley are closed, said trolley will slide down the string and be returned to the person flying the kite, in order that it may again be sent up, if so desired.

APPARATUS FOR REDUCING ANTIMONY ORES.—Edwin Kratzer, Thompson Falls, Mont. The object of the invention is to provide a new and improved apparatus to extract antimony from its ores, separate it from the gangue in a simple and economical manner by sintering the ore, fuming, oxidizing, and condensing the antimony, and collecting it as an oxide of antimony in the form of a powder in a common condenser. The apparatus consists principally of a center or dranght furnace having side draught holes and a cone or equivalent body in its bottom, the cone being formed with a center draught inlet, and a series of channels leading from the inlet to the sides of the cone.

LOG SAWING MACHINE.—John H. Estabrooks, Hinckley, Ill. The invention is an improvement in the class of portable log sawing machines which are adapted to be attached to and partly supported by the log to be sawed, and on which the operator sits to reciprocate the saw. In brief, the invention consists of a portable sawing machine of the type specified, and of the combination with the frame, having a seat of a pendulum saw, and connecting rod and of a pivoted standing lever and pendent lever, and having meshing toothed heads, the pendent lever having foot rests whereby the levers are made to move together in the same direction.

MARLINESPIKE.—Charles H. Fulson and James M. Doyle, Vidalia, La. The improved marlinespike is smooth and tapered exteriorly, and provided with a screw socket for reception of and attachment to a rope end. The marlinespike or splicing tool is provided with an internally threaded socket, and an internally threaded extension socket of greater diameter having a coupling screw on its forward end to screw into the first named socket.

MOTOR.—Ira J. Griffin, Sing Sing, N. Y. The object of the invention is to construct a simple and effective motor, to be used with water or any other suitable propelling agent. In brief, this fluid motor comprises a wheel provided with a rim, buckets secured to the outer surface of the rim, each bucket having a broad front face provided with a transverse cylindrical groove open at both ends, and a rear portion tapering to a sharp edge, said edge extending inwardly beyond the tangent at the inner end of the groove of the adjacent bucket, to throw the waste fluid laterally before it reaches the rim, and means for throwing jets of a fluid into the grooves of the buckets.

TONGUE SUPPORT FOR VEHICLES.—James F. Mitchell and Enos A. Rich, Opolis, Kan. This invention relates to a support for the tongues of vehicles, and the object of the invention is to provide such a support of simple, durable, and economic construction and of a resilient nature, the support being so applied to the tongue that it will carry the weight of the tongue in any desired position of the latter, and whereby the support at its forward or free end will have sliding connection with the tongue, enabling it to be raised to any desired height without interfering with the downward movement of the tongue, which may be pressed to the ground, and when relieved from pressure will resume its normal position. In brief, the invention consists of the combination with a running gear of a vehicle and the tongue of the same and of a support for the tongue having pivotal connection with the running gear, a yoke keeper attached to the tongue, in which the forward portion of the support has movement, and a locking device adjustable on the yoke keeper and adapted for engagement with the forward end of the support.

BREECH-LOADING FIREARM.—Manuel Victor Dengo, San Jose, Costa Rica. The object of the invention is to provide a new and improved breech-loading firearm, which is simple and durable in construction, easily manipulated, arranged to securely hold the breech block in position when firing, and to readily extract the shell. The invention consists principally of a breech block controlled during part of its closing movement by the hammer and the remainder by a spring, so as to seat the breech block in advance of the hammer.

AMALGAMATOR.—Charles P. Watterson, Farmington, Utah. The object of the invention is to provide a new and improved amalgamator for treating gold-bearing sand, stamp mill pulp, and other material to save the precious metals contained therein in an effective, quick and economical manner. The invention consists principally of a gyrating box provided with copper plates, and a longitudinal guide strip for the said plates, each strip extending from one of the boxes to within a short distance of the other end, to cause the material passing upon the plate on one side thereof to travel along the same and back on the other side.

END GATE AND FASTENING DEVICE THEREFOR.—William C. Herriman, Roads, Mo. The invention is especially designed as an improvement in the end gates of wagons adapted to carry grain, as well pigs and other stock, and the object of the invention is to provide an end gate which, when fastened in place, will afford a substantial brace for the end of the wagon body, to prevent injurious shaking of the body when being drawn over rough roads; to provide an end gate which may be readily and securely fastened in the closed position, and which may be readily lowered and properly secured in position for the ready unloading of grain without injuring the bottom of the body, and which may be fastened in a further lowered position to form a runway, as to a hog chute or the like. When used for hauling stock, it can be raised or lowered speedily and coveniently while the wagon is backed and while remaining against the stock chute. The invention consists in the combination with a wagon body of an improved end gate, to which are attached two chains having rings at the outer ends, rings inward from the ends, one of said rings being smaller than the other, and a third ring on the chain having the said smaller ring and means for securing the inner end of each chain.

HINGE.—Paul E. Cabaret, New York City. The invention relates to an improvement in hinges, and especially to that class of hinges known as "stop hinges," the object of the invention being to provide a hinge particularly adapted for hanging heavy doors, as bronze doors, and likewise especially adapted to be attached to masonry, and so provide the hinge with stops that the door cannot be opened beyond a predetermined angle, and whereby also the stops will add materially to the strength of the hinge and materially assist the latter in supporting the door. This is a knuckle hinge, comprising attaching plates having knuckles pivotally connected together and each provided on its inner face with a lug of the same width as the knuckle and extending from the attaching plate partially over the knuckle and adapted to engage the opposite attaching plate, to limit the movement of the parts of the hinge one upon the other, the lug of one knuckle projecting between the lugs of the two adjacent knuckles, the said lugs being of a length to remain in interlocking engagement with each other at all times.

PICKER STICK CHECK FOR LOOMS.—William E. Sartwell, Troy, Vt. This invention is a picker stick for looms, comprisng two plates adapted to be secured to opposite sides of the batten or lathe, said plates each being provided with a laterally projecting and recessed lug, and with a laterally projecting stop in front of the said lug, said stop having yielding or elastic faces, a U-shaped arm having the ends of its members pivoted in the recesses of the lugs, a stop plate secured to the horizontal or connecting portion of the arm, and springs, each provided with a coil between its ends, the said springs having one end secured to the rear portions of the said lugs and their free ends loosely engaging the members of the arms at about midway of their length.

PUMPING POWER.—George W. Grimes, Bluffton, Ind. This invention relates to mechanism for pumping oil and water wells, the object being to provide a simple and compact form of the construction, bringing all wearing points within the limits of easy access, and further, to provide a frame of strong and novel construction in which may be supported one or more devices of different sizes for connection with pump rods or lines, whereby a greater length of throw in said pump rods or lines may be secured than has heretofore been done. In brief, the invention consists in a well pumping power, a frame, a vertical shaft having bearings in said frame of a bevel gear on said vertical shaft, a horizontal shaft having a bearing in a boxing on the frame, a pinion on said horizontal shaft engaging with the gear on the vertical shaft, a series of cranks arranged on the vertical shaft, one above another, and pump rod plates mounted on the cranks, the connected cranks and plates of one set being arranged to move in a smaller circle than those of an adjacent crank and plate.

MACHINE FOR MAKING CONTINUOUS INLAID LINOLEUM.—Louis William Lowe, Linoleumville, N. Y. The object of the invention is to provide a new and improved machine for making continuous inlaid linoleum in a very simple and economical manner. In brief, the invention consists in the combination of the assembling cylinder provided at its periphery with devices for holding the material, feed mechanism arranged adjacent to the assembling cylinder to deliver pieces of material thereto and form said pieces into a continuous sheet, and a guide roller over which passes a sheet of backing, said roller being arranged adjacent to the cylinder, but in advance of the feed mechanism, to guide the backing to the continuous sheet of assembled pieces on the cylinder and bring said pieces and backing together to form a continuous, coherent sheet.

COIN FREED LETTER POSTING OR STAMPING MACHINE.—Detalmo Di Brazza Savorgnan, Rome, Italy. This invention relates to letter boxes or receptacles designed to be placed in any desired locality for depositing letters to be mailed, and it comprises mechanism for progressively numbering the envelopes as they are deposited and after the proper coin or coins shall have been deposited to prepay the postal fee. In this machine or depository is embodied means for indicating on the envelope the place and date of deposit, the numeral or numerals which serve in lieu of the ordinary printed and attached stamp, and also means to designate on the envelope the amount of postage deposited therefor, whether domestic or foreign. It further embodies means for making a permanent record of the number on the last letter deposited prior to the removal of the letters by an authorized agent of the government, and also means for making a permanent record of the whole amount of coin removed from the machine by an authorized agent. It further embodies means whereby a letter may be placed in the machine and operated upon after a coin shall have been placed in the proper chute, and whereby the said letter may be returned to a position to be removed by the depositor, should he be aware that a greater amount of postage is required, thereby enabling him to again deposit the letter with a sufficient amount of coin to wholly prepay the postage.

TOBACCO GRANULATOR.—John W. Daniel, Owensborough, Ky. This invention relates to certain improvements in granulating machines, such as are especially adapted for granulating tobacco. The invention consists in a machine for granulating tobacco, of the combination of a body having an open top and provided with an opening near the bottom of its front wall, a curved screen having a concave upper face arranged at the upper part of the body, a curved cover hinged at its rear edge to the upper part of the rear side of the body and provided with a hopper in its top and a discharge opening in its rear part, a shaft journaled transversely at the upper part of the body, the curvatures of said screen and of the cover being concentric with said shaft, whereby a circular chamber is formed at the upper part of the body, a drum secured on said shaft inside said circular chamber and provided on its periphery with projecting blades arranged to press the tobacco leaves against said curved screen and to throw the refuse through the discharge opening in the rear part of the cover, an inclined screen pivoted in the lower part of the body, with its extremity extending through the opening in the front wall thereof, said inclined screen being adapted to receive on its upper side the granulated material passing through said curved screen and having means for vibrating it, said body having its rear wall closed from the discharge opening in the cover down beyond the rear end of said inclined screen, and a dust receptacle arranged in the bottom of the body below said inclined screen.

MANUFACTURE OF SEAMLESS TUBING.—Hartley Howard Jack, Hollidaysburg, Pa. The invention is an improvement in the manufacture of seamless tubing, and it consists in the improved process and in the apparatus. The process includes rolling or compressing the ingots while the same are upon a revolving longitudinally movable mandrel section, whereby there is imparted to the interior of the ingot, while the exterior thereof is being compressed, broadly, a rotary motion, and specifically, a rotary spiral motion.

DEVICE FOR AUTOMATICALLY CONTROLLING CLOSING HATCHWAY OR OTHER DOORS.—Frederick F. Jackson, Richmond, Ind. This invention relates to a device for automatically controlling the closing of hatchway or other doors, and it has for its object to provide a system of wiring having connection with the locking mechanism for the doors, and a series of fusible links in the wiring, which will quickly melt in case of fire and allow certain releasing mechanism to operate. In brief, it consists of a device for automatically controlling hatchways or other doors, comprising door locking mechanism, a suspended weight for releasing the locking mechanism, means for holding said weight suspended, a chain or the like forming part of said holding means, a wire, having fusible links extended about the ceiling, one end of said wire engaging a tension device for said chain, a pivoted lever forming part of the tension device, and a connection between the lever and chain or the like.

FLUSHING APPARATUS.—Fra P. Giliberti, Wood Haven, N. Y. The invention relates to flushing devices for closets; and the object is to provide an apparatus simple in construction, in which float valves are dispensed with, and in which the flushing water will discharge under considerable pressure. The invention consists in a flushing apparatus, of the combination with a bowl of a stand pipe comprising a cylinder or tank, a controlling valve in the stand pipe between the cylinder and bowl, an overflow pipe communicating with the stand pipe between the controlling valve and bowl, and having a connection with the upper end of the cylinder, an automatically opening check valve in said connection and an adjustable air valve communicating with said connection.

WRENCH.—William John Leach, Brighton, Wis. The invention reletes to wrenches used for applying and removing vehicle axle nuts, and its object is to provide a new and improved wrench which is simple and durable in construction, and arranged to securely hold the nut in place after removal from the axle, to prevent the greasy nut from soiling the hands of the operator and from falling upon the ground and becoming soiled itself. The wrench is provided with an open arched jaw, the members of which have slots in their ends and an arched spring fastened at its middle to the middle of said jaw and hugging the sides thereof, its lower ends being curved upwardly and inwardly through said slots, whereby their extreme ends project within the inner faces of said jaw to engage the sides of a nut.

BICYCLE SUPPORT.—Walter J. Smart, South Orange, N. J. The invention relates to racks or supports for bicycles, and the object is to provide a simple device adapted to engage and support a bicycle without attaching the device to the wheel or frame by means of clamps or similar devices, which not only mar the machine, but require a considerable time to adjust. It consists of a bicycle support, comprising a single strip of metal bent to form vertical members and horizontally disposed members arched upward between their ends to engage a wheel, a base block secured at the junction of the vertical and horizontal members and a front base block secured to the ends of the horizontal members, the said front block having its upper surface inclined downward in both directions from a line between its front and rear edges.

STEP LADDER.—Charles H. Dyar, of Ontario, Cal. The invention relates to step ladders, and particularly that class of step ladders in which the support or brace is provided with rungs, and is adapted to form an extension of the step ladder proper by being swung on a pivot until it aligns with the step ladder. The improvement consists of a ladder comprising two pivoted sections, one of which embraces the ends of the other section, the narrow section having above and below its pivot point outwardly extending projections whose faces are adapted to simultaneously engage the sides of the wide section above and below the pivot point thereof when the sections are swung into alignment.

SULKY.—Clarence Eugene Brockman, Mount Sterling, Ill. The invention relates to an improvement in sulkies, and especially to an improvement in racing sulkies; and the object of the invention is to so connect the wheels with the frame of the sulky that the said wheels will offer but comparatively little resistance when turning a curve, since the wheels will be so hung that they will automatically conform to the curve to be taken. A further object of the invention is to provide braces for the wheels, which in event of the guide arms regulating the turning of the wheels should break, said braces will act to prevent the wheels taking a position dangerous to the safety of the rider. The invention consists in a sulky, of a frame, hangers pivotally mounted in the frame and arranged to journal the wheels of the sulky, and guide arms attached to the hangers, having sliding movement at their forward ends on the shafts of the sulky, whereby the wheels will accommodate themselves to the curves around which the sulky may be drawn.

PUMP.—Antoine Aristide Delpeyrou and Léon Joseph Rousselin, Paris, France. The invention consists of certain features of improvement relating to that class of pumps in which in lieu of a piston or plunger a bellows-like compressible chamber, made of India rubber, is employed by the forcible expansion and compression of which the liquid is alternately sucked into the pump and forced to the required height. The invention includes various novel features. It comprises a pressure disk connected to the pump rod and adapted to compress the bellows chamber, the disk acting also as a piston to draw water into the casing surrounding the bellows chamber, so that water is forced alternately up by the bellows through the hollow piston rod and upward throngh the casing surrounding the bellows.

WINDMILL.—Jacob L. Rust and Franklin M. Rust, Gladstone, Ill. The invention relates to certain improvements in windmills, and has for its object to provide a mill of a simple and inexpensive construction, which shall be strong and durable and not liable to become broken or deranged, having its wind wheel provided with means for holding it normally in the wind, and adapted, when the wind becomes too high, to permit the operation of the wind wheel with safety, to be thrown out on the wind. In brief, the invention consists in a windmill, of the combination of a base piece, a shaft mounted to turn thereon and adapted to swing in a horizontal plane, a wind wheel mounted on said shaft and provided with a clutch member at one end, a clutch member connected to the shaft, a spring arranged to hold the clutch member on the wind wheel normally engaged with the clutch member on the shaft, means for moving said clutch members out of engagement and gearing connected to said shaft.

OIL WELL PUMPING POWER.—George W. Grimes, Bluffton, Ind. The invention relates to devices for converting motion to pump actuating rods or lines, for the purpose of pumping oil or water wells

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which may be distributed over a considerable territory and in any direction from the power, and to successfully operate them in numbers. A leading object of the invention is to reduce to a minimum the friction between the eccentrics and the pump rod rings, thus adapting the device for the operation of a large number of surrounding pumps at the expenditure of comparatively small amount of engine driving power.

Electrical.

ELECTRICAL APPARATUS FOR CONTROLLING MOTION OF CRANES.—John Augustus Essberger and Alexius Wilhelm Geyer, Berlin, Germany. With the introduction of the method of actuating, raising and lowering apparatus of all kinds by electrical energy, it was felt necessary to effect a simplification not only in the general construction of the apparatus, but also in the appliances for controlling and regulating the working thereof. The present invention has reference to the latter purpose, and consists in two arrangements whereby the movement of a load by means of cranes or travelers can be easily controlled and regulated by electrical energy in a manner capable of ready supervision. With cranes having two separate motors, one for raising the load and the second for turning the crane, there are provided, more particularly in electric cranes, two starting and regulating resistances, and in addition for working the brakes there is a lever for each brake. If now rheostats without automatic reversal of the motion are provided, the engineer will, under certain circumstances, have to work six levers.

Agricultural.

GRAIN SEPARATOR.—John Wesley Woodruff, Wise, West Virginia. The invention relates to improvements in grain separators, and has for its object to provide a separator by means of which grain and the like can be thoroughly separated, cleaned and graded. The invention has also for its object to provide means whereby the several parts can be quickly and readily adjusted to suit different kinds of grain or seed. A still further object of the invention is to provide a very simple, inexpensive and effective machine. In brief, the invention consists of the combination with a vibrating screen frame, a hopper pivoted at its rear end and having an interlocking engagement at its front end with the side bars of the screen frame.

ROTARY HARROW.—James G. Ferrill, Batesville, Ark. This invention is an improvement upon the harrow for which the same inventor has already obtained a patent. This former patent consists essentially of two rotary harrows connected by a rigid coupling. The new improvement consists in the construction of the devices for coupling the harrows and the construction and attachment of the tongue or pole.

Miscellaneous.

BEDSTEAD FASTENING. — Edwin F. Tilley, New York, N. Y. The object of the invention is to provide a superior fastening of that class used in connection with bedstead side rails constructed of angle iron, the purpose being to provide a device which is reversible, whereby the horizontal member of the side rail may be placed at the upper or lower portion of the vertical member. In brief, the invention consists of a bedstead fastening, of the combination of a leg section having two lugs, and a pin held between said lugs, a side rail section having vertically aligned lugs adapted to fit within the space between the lugs on the leg section, and a hook pivotally mounted on the side rail section and adapted to align with the lugs on said section and also adapted for engagement with the pin on the leg section.

PENCIL HOLDER.—Granville Bartlett, Rushville, Indiana. This invention is an improved pencil holder adapted for wear upon the coat, vest, or similar garment. In brief, the invention consists of a pencil holder composed of a main plate having its opposite sides bent, forming jaws hinged to said plate and cooperating with the jaws thereof and means for securing the holder in position for use.

POOL TABLE RACK AND TALLY.—George F. Goss, Wallaceton, Pa. This invention is an improvement in pool tables and especially in the racks therefor, and the invention has for an object to provide certain improvements upon the device shown in a former patent issued to the same inventor. In brief, the invention consists in a pool table of a series of oscillating frames movable one in one direction and the next in the reverse direction, and provided after the first of the series with projecting arms or portions arranged to engage the preceding or next frame in advance, whereby as the frames are successively moved each will return its immediately preceding frame to its original position, and devices controlling the passage of the balls connected with and operated by said frames.

SWEETENING OILS.—Martin H. Smith, New York, N. Y. The object of the invention is to provide certain new and useful improvements in sweetening fixed and essential oils, whereby the general nature of the oil treated is not affected to any perceptible degree. The invention consists of phloroglucin or glucin, $C_6H_3(HO)_3$, forming a solution with the oil. As heretofore practiced, oils were sweetened by dissolving in them by maceration, with or without the aid of heat and by the aid of acids or alcohol, the sweetening agents saccharin or dulcin, or by adding saccharin, dulcin, or sugar to an emulsion of the oils.

SPOOL WIRE FRAME.—Russell Fraser, of Brooklyn, N. Y. The object of the invention is to provide a frame especially adapted for holding spools of wire, the frame being so constructed that the spools, when full, or partially full, are held firmly in place, and whereby when the spools become empty they can be expeditiously and conveniently removed and full spools substituted. The invention consists in a spool frame or rack for wire, having brackets longitudinally secured to a lock plate near each side thereof, each bracket having circular openings therein, said openings being in horizontal alignment and adapted to receive spindles loosely passed therethrough, on which are mounted spools wound with wire and angular spring plates consisting of a shank member secured to said back plate at the rear of each spool, and a longer tension member adapted to bear firmly against the wire on the spool, whereby a strong frictional engagement between said spindles and said openings is effected.

YARN DYEING MACHINE.—Jonathan William Grant, Fall River, Mass. The object of the invention is to provide a new and improved machine for dyeing random or variegated cotton or other yarn in a very simple and economical manner. In brief, the invention consists in a dyeing machine provided with a revoluble drum comprising a series of longitudinal bars, which support the yarn in hanks, bearings for the said bars provided with a cam surface, a clamping bar for each longitudinal bar and a lever connected with each clamping bar and adapted to engage the cam surface of the bearing for the corresponding longitudinal bar.

WATER GUN.—John Walter Wolff, Winston, North Carolina. The invention is an improved water gun, and the invention has for an object to provide a simple construction of gun or pistol in which, as the gun is fired, a water bulb or ball will be compressed and cause a stream of water to be ejected from the muzzle, furnishing an effective and amusing toy. It consists of a gun or pistol provided with a bulb or ball and a bulb compressor carried by the gun or pistol and operated by the act of firing.

SHOE.—Landlin Rieger, Ottoville, O. The object of the invention is to provide a new and improved shoe, which can be cheaply manufactured, is durable, retains its shape when used, and at the same time is sufficiently flexible to insure comfort. The invention consists principally of a shoe formed of a single piece of flexible material, and having its sides and quarters cramped up from the sole to unite the sides with the side edges of the vamp or tip, likewise cramped up from the front end of the sole.

AUTOMATIC CUTOFF AND FILTER.—Edward C. Fremaux, Rayne, La. This invention relates to devices for discharging rain water from a roof into a cistern or similar receptacle, the object being to provide a device whereby the initial flow of water from a roof, at the beginning of a rain storm, will be directed to the ground outside the cistern, thus preventing dirt and impurities that may have gathered on the roof during a long dry spell from entering the system, and then, after the roof shall have been thoroughly cleaned or washed, to direct the water into the cistern. With this end in view, the invention consists in a receiver attached to the lower end of a water leader, and comprising two legs or members, one of which is extended into the cistern and the other directed to the outside thereof, and having means for automatically changing the direction of the water flow.

HORSE SHOE.—Edward W. Euge, Lebanon, Mo. The object of the invention is to provide a new and improved horse shoe, arranged to permit of readily removing worn-out toe and heel calks and replacing the same by new ones, without weakening the shoe or removing it from the animal's hoof. The invention consists of a toe calk and heel calks, each having an apertured flange, key pins held on the shoe and passing through the apertures in the flanges, and keys for the pins for securely engaging the faces of the flanges and securely fastening the calks in place on the shoe.

Designs.

DESIGN FOR A HANDLE FOR SPOONS.—Austin F. Jackson, Taunton, Mass. The principal features of the front face of the design are a smooth convex panel, a terminal ball with inturned scrolls. Beaded scrolls extend along down toward the swelled portion, which latter has marginal inturned scrolls. A marginal bead extends along the shank portion to the swelled portion of the spoon bowl or fork head and terminates in a scroll displayed along the edge of the latter. The principal features of the back side of the handle is a concave panel, whose end is surmounted with the same terminal ball and symmetrical scrolls that appear on the face. A marginal bead extends along the edge of the wide portion of the handle to the swelled middle part, which latter has a series of inturned shoots or buds. The same marginal bead which appears on the front side also appears on the back side of the shank, while a shell pattern of scrolls is placed on the broad end of the bowl of the spoon or broad head of the fork at the point where the handle joins onto it.

DESIGN FOR A SPOON.—Austin F. Jackson, Taunton, Mass. This design is mainly distinguished by a handle, the cross section of which presents a broad central corrugation and narrower corrugations at the sides. The design also includes certain novel scroll-like ornaments and beaded work.

DESIGN FOR A CULINARY UTENSIL.—Annie Leonard, Lawrence, Kansas. The design in its entirety presents a top of circular form and an inwardly and downwardly projecting circular flange, the said top having a depressed center in which appears a horizontally disposed cylindrical member, and a loop joining with such cylindrical member at the ends of the atter, the top and the flange having numerous openings. The leading feature of the design consists in the utensil having a circular top and the flange projecting inwardly and downwardly from the top at the edge.

DESIGN FOR GARMENT HANGER. — Zephiren Duchemain, Haverhill, Mass. The hanger comprises the wire skeleton top presenting the two oppositely projecting horizontal members, the sides of which have downward extensions, two of which are joined by a crosspiece having a downwardly turned upper end, the forwardly extending member, that is composed of two arms forming continuations of the extensions, the said arms being return bent the vertical skeleton shank, the two members of which are continuations of the forwardly extending member, and the hook-like termination which ranges upward and outward in front of the shank, and the members of which hook have rearward bends which are joined to the shank by downwardly and inwardly curved bends that cross at the bottom of the hanger.

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(6896) T. O. Z. writes: Kindly explain why the days continue to lengthen in the evening to the end of June and December, while they shorten in the morning at the same time. A. The change in the time of the rising and setting of the sun throughout the year is due to the eccentricity of the earth's orbit. The sun being in one of the foci of its elliptic orbit, the earth does not move with the same apparent or angular velocity through its semi-ellipse, which causes the angular position of the sun to vary with the position of the earth in its orbit for every day in the year. The sun being apparently slow or behind clock time from about December 24 to April 15, when sunrise and sunset are at equal times from 6 o'clock. The sun then begins to be slow, and returns again to clock time about June 15, when it again becomes fast and returns to clock time about September 1, then again slow until December 24. Thus four times in a year the solar and mean time correspond; at all other times the sun is ahead or behind the mean time, and as sunrise and sunset is recorded in the almanacs in mean or clock time, the variation of the rising and setting of the sun from 6 o'clock shows the amount of the sun's apparent eccentricity due to the elliptic orbit of the earth, a small part of the variation being also due to the inclination of the earth's axis to the elliptic.

(6897) C. B. A. says: 1. If you deem it of sufficient general interest, I would be pleased to know, through your query column, of some good preparation for applying to pasteboard or celluloid to make an artificial slate. A. Dissolve 4 ounces shellac in 1 quart alcohol; add lampblack, 6 drachms; ultramarine blue, 1 drachm; pumice stone, powdered, 3 ounces; rottenstone, powdered, 2 ounces. Have the board dry and free from grease. Sodium silicate, diluted with water, and colored with lampblack, suspended in a little of the silicate, makes an excellent slating. 2. Formula for luminous paint. A. For formulas for luminous paint see SUPPLEMENT, Nos. 229, 249, 497, 539, 922, 939, price 10 cents each.

(6898) L. B. P. says: Will you please give me through the columns of the SCIENTIFIC AMERICAN a receipt for cleaning wool carpets without removing from the floor? A. Have ready a number of dry coarse cotton or linen cloths, some coarse flannels and one or more large pieces of coarse sponge; two or more hard scrubbing or scouring brushes, some large tubs or pans, and pails, and also a plentiful supply of both hot and cold water. First take out all grease spots; this may be effected in several ways. Well rub the spot with a piece of hard soap and wash out with a brush and cold water, and well dry each spot before leaving it. Or use, instead of the soap, a mixture of fuller's earth, gall and water, well rinsing and drying each spot as before. When this has been done, the carpet may be cleaned by the first method mentioned.

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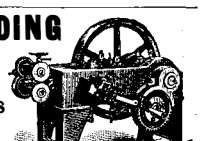

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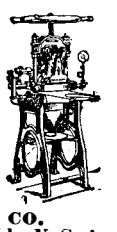

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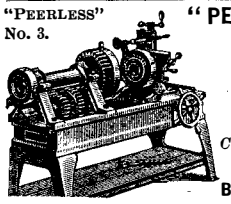

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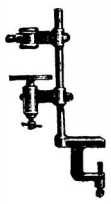

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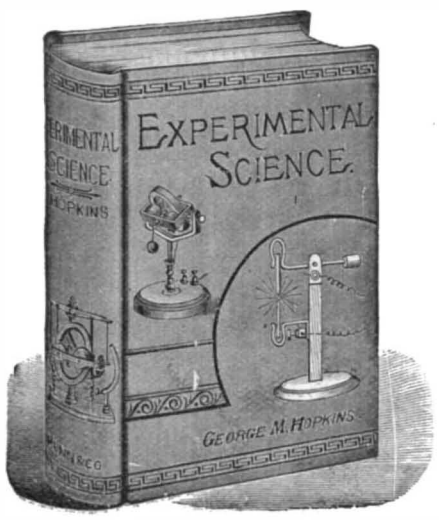

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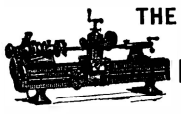

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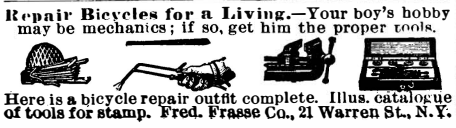

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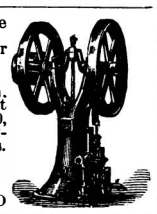

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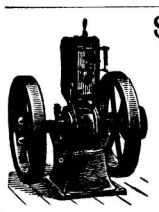

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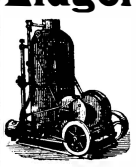

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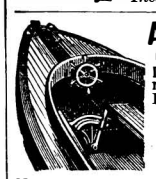

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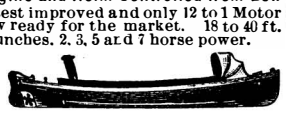

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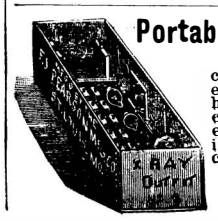

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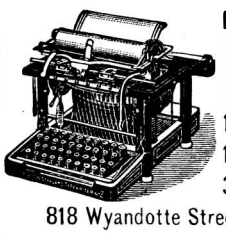

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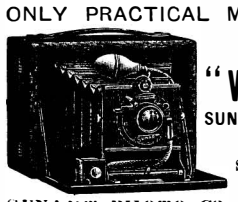

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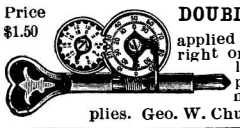

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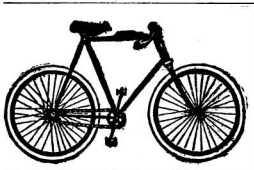

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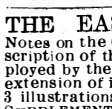

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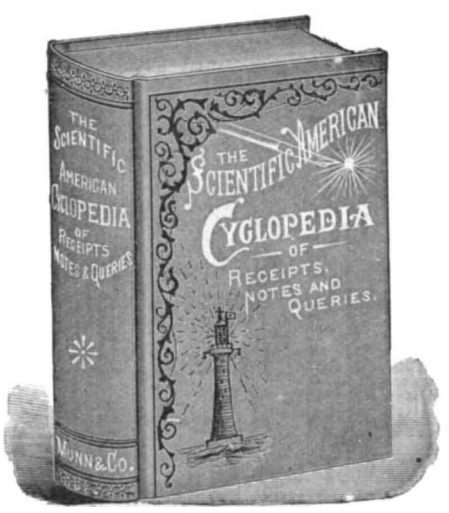
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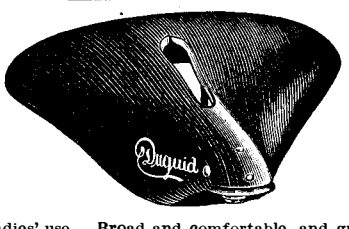

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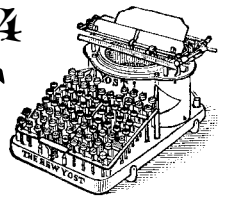

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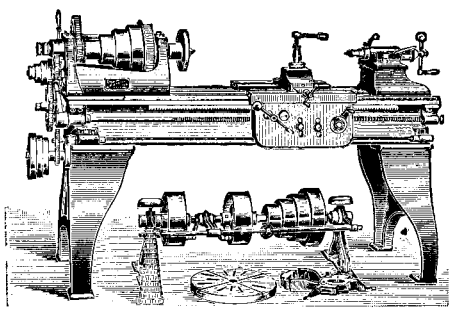

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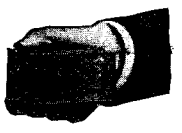

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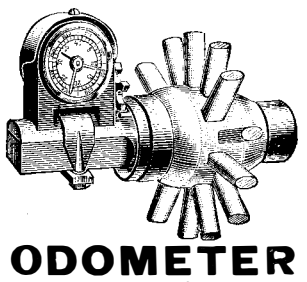

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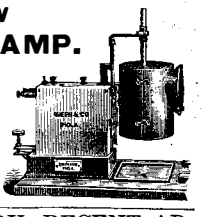

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